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Superfund Record of Decision:

Rasmussen's Dump, MI

272-101

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15. Supplementary Notes

16. Abstract (Limit: 200 words)

The 33-acre Rasmussen's Dump site is a former industrial and domestic waste disposal area in Green Oak Township, Livingston County, Michigan. Surrounding land is predominantly wooded with some residential and agricultural development. Area residents rely solely on the aquifer underlying the site for their drinking water supply. The site is adjacent to the Spiegelberg Landfill, another Superfund site. During the 1960s and early 1970s, domestic, industrial, and drummed hazardous wastes were disposed of on approximately one-third of the site. Many incidences of onsite burning of wastes were reported during operational years of the facility. Landfill operations ended in 1977 without complying with State laws on proper capping or closure. Sand and gravel mining, which began following site closure, caused unearthed waste fill and drummed wastes to be redistributed around the site. In 1981, the State detected low levels of ground water contamination onsite. This contamination includes: two onsite contaminated ground water plumes and four areas of soil contamination referred to as the Top of the Municipal Landfill (TML), the Northeast Buried Drum Area (NEBD), the Industrial Waste Area (IW), and the Probable Drum Storage, Leakage, Disposal Area (PDSLD). In 1984, EPA removed approximately 3,000 drums and 250 cubic

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Rasmussen's Dump, MI
First Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOCs (benzene, TCE, toluene, xylenes), other organics (chlorinated hydrocarbons, ketones, phenols), metals (cadmium, lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 174
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(See ANSI-Z39.18) See Instructions on Reverse

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Abstract (Continued)

yards of contaminated onsite soil. In 1990, the PRPs removed an additional 650 onsite drums, waste, and associated visibly contaminated soil from the TML, NEBD, and IW areas, thereby reducing the risk posed by the areas. Testing in the PDSLD area indicated that soil contamination resulting from drum leakage continues to migrate into the soil directly above the ground water table or into the ground water itself, and poses a continuing ground water threat. This Record of Decision (ROD) provides a final remedy for onsite contaminated soil and ground water. The primary contaminants of concern affecting the soil and ground water are VOCs including benzene, TCE, toluene, and xylenes; other organics including ketones, chlorinated hydrocarbons, and phenols; and metals including cadmium, and lead.

The selected remedial action for this site includes capping the waste in the TML and NEBD areas, and removing and disposing of waste drums unearthed during cap construction offsite at a RCRA facility; ground water pumping and treatment using chemical precipitation followed by pH adjustment to remove metal contaminants, a biological treatment system to remove organic ground water contaminants, and air stripping and granular activated carbon to remove residual organic contaminants as necessary; discharging the treated ground water onsite through a seepage basin in the IW and PDSLD areas to flush area soil monitoring ground water; continuing residential well sampling in conjunction with sampling for the adjacent Spiegelberg Superfund site; and implementing institutional controls including deed restrictions, and site access restrictions such as fencing. The estimated capital cost for this remedial action is $7,320,000, with an annual O&M cost of $4,580,000.

PERFORMANCE STANDARDS OR GOALS: Soil contaminant levels in the PDSLD/IW areas will be reduced to less than 20 times the ground water clean-up level for each chemical; or leach tests performed on the PDSLD/IW soil must produce leachate with concentrations below the ground water clean-up levels. Ground water clean-up goals are based on a 10^{-6} cancer risk level, Human Life Cycle Safe Concentrations (HLSC) detection limits, Taste and Odor (T&O) Threshold, State standards, and risk- and health-based criteria. Chemical-specific goals for ground water include benzene 1.2 ug/l (risk-based), TCE 3 ug/l (10 risk level), toluene 800 ug/l (T&O), xylenes 300 ug/l (T&O), cadmium 4 ug/l, and lead 5 ug/l (HLSC). Cleanup for cadmium and lead will not be required if filtered lead and cadmium samples are 5 ug/l and 4 ug/l, respectively, or if onsite filtered lead and cadmium levels are greater than 5 ug/l and 4 ug/l respectively and these onsite filtered lead and cadmium levels are equal to or less than their corresponding filtered background levels.

DECLARATION FOR THE RECORD OF DECISION

Site Name and Location

Rasmussen Dump Site
Green Oak Township, Livingston County, Michigan

Statement of Basis and Purpose

This decision document presents the selected final remedial action for the Rasmussen Dump Site, in Livingston County, Michigan. The final remedial action was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the factual and legal basis for selecting the remedy for this site.

This decision is based upon the contents of the administrative record for the Rasmussen Site. The Administrative Record Index is included as Appendix 1.

The United States Environmental Protection Agency (U.S. EPA) and the Michigan Department of Natural Resources (MDNR) agree upon the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of the Selected Remedy

This final response action addresses the Rasmussen groundwater plume area of concern (the remaining principal threat), the four Rasmussen soils areas of concern, and any drums or concentrations of industrial waste encountered during the implementation of response activities on the groundwater and soils.

The Remedial Investigation (RI) and associated Risk Assessment Report for the Rasmussen Dump site identified areas of concern including areas of disposed hazardous waste, contaminated soils, and groundwater. Two interim source control measures were completed at this site.

1. In the fall of 1984, the U.S. EPA Emergency Response Team removed nearly 3,000 drums and 250 cubic yards of contaminated soils from the top and south face of the dump.

2. In early 1990, the Potentially Responsible Parties (PRPs) concluded the voluntary removal of roughly 650 drums, waste and associated visibly contaminated soils from the Northeast Buried Drum (NEBD) area, Top of Landfill (TML) area, and the Industrial Waste (IW) area. This was carried out under the directive of the U.S. EPA Administrative Consent Order of August 24, 1989.

These removal actions significantly reduced the quantity of containerized waste, reducing a portion of the principal threat posed to public health, soil and groundwater resources.

The final remedial action chosen for the Rasmussen Dump Site, and described in the attached Record of Decision will:

* reduce the potential for human exposure to hazardous substances in the contaminated groundwater resource;

* reduce the potential for human exposure to hazardous substances from contact with contaminated soil areas;

* reduce the potential for remaining hazardous substances to contaminate other resources.

The principal threats will be mitigated by the groundwater extraction and treatment system. Reintroduction of treated groundwater through the Probable Drum Storage, Leakage, Disposal (PDSLD) area and the IW area will flush the contamination into the closed-loop groundwater extraction and treatment system, where they will be removed. This will eliminate current and potential threats to the groundwater resource from these two areas. The low-level threats posed by contact with, or further migration of contaminants toward the groundwater resource in the remaining soils areas (NEBD and TML), are mitigated by construction of a Michigan Act 64 clay cap over these areas, with the additional protection afforded by fencing and deed restrictions. The remedy will be closely monitored throughout implementation and corrective action will be taken, should monitoring indicate the ineffectiveness of any component of the remedy.

The remedy chosen to address the two areas of groundwater contamination and the IW and PDSLD soils areas includes:

* extraction of groundwater to capture and halt the flow of the plumes.
* removal of heavy metal contaminants by chemical precipitation followed by pH adjustment (if necessary).

* removal of several organic contaminants, including ketones, by a biological treatment system.
* removal of residual organic contaminants via air stripping.
* further removal of residual organic contaminants via granular activated carbon (GAC) (or other carbon adsorption methodology, if necessary).
* discharge of treated water to the groundwater via a seepage basin situated over the IW and PDSLD soils areas of concern.
* groundwater monitoring through a system of wells to assess the effectiveness of the system at:
    * halting the migration of contamination.
    * reducing the levels of contamination in the soils and groundwater, over time.

* a process effluent sampling program to aid in determining the treatment system's effectiveness.
* fencing and deed restrictions, as necessary, to ensure the integrity of the remedy.

Residential well sampling will be continued, in conjunction with that called for in the final remedial actions at the neighboring Spiegelberg Superfund Site.

The final processes to be installed for groundwater cleanup will be determined by treatability studies during design.

In the location of groundwater monitoring well RA-MW-27, groundwater will need to be purged from this location and will need to be manifolded into the treatment system feed supply line for treatment prior to discharge.

The final remedial actions to address the threat posed by the TML and NEBD soils areas of concern include:

* A Michigan Act 64 clay cap constructed over all wastes in the TML and NEBD areas of concern as they now exist spatially on-site. This includes:
    * a one-foot thick vegetated soil layer on top,
    * a drainage layer at least 1 foot thick, and
    * a layer of compacted clay 3 feet thick with a permeability of 1E-07 cm/sec or less.
* A groundwater monitoring program established at appropriate locations, depths, and frequency, to detect any changes in groundwater quality, which would indicate any failure of the unit.
* Access restrictions, such as fencing, will be placed around the capped soil areas.
* Institutional controls, such as deed restrictions, will be put in place to prevent future intrusive land uses.
* Drums of waste which are currently visible, or which are unearthed during cap implementation, will be disposed of at a licensed RCRA facility.

This portion of the final remedial action will require long-term management to ensure that the integrity of the capping system is not compromised. The access restrictions and fencing will aid in this effort. Long-term management efforts will include periodic well sampling, cap inspection and repair (if necessary), and maintenance of vegetative cover.

Details of the capping construction such as the potential employment of terracing, rip-rapped drainage channels, and perimeter runoff collection will be detailed during the design phase of remedial action.

Declaration of Statutory Determinations

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the final remedial action, and is cost-effective.

This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable, although it does not entirely satisfy the statutory preference for treatment as a principal element. Portions of the groundwater/soils remedy reduces contaminant toxicity, mobility, or volume through treatment of the principal threat. However, treatment of the low-level threats posed by the soils areas to be capped, was not found to be practicable or cost effective. Drummed industrial wastes, a former principal threat at the site, has been largely eliminated through previous removal actions.

A review will be conducted within five years after commencement of the final remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment, because this remedy will result in hazardous substances remaining on-site above health-based levels.

Valdas V. Adamkus

March 28, 1991

Valdas V. Adamkus
Regional Administrator
U.S. EPA - Region V

Date

DECISION SUMMARY FOR THE RECORD OF DECISION

Site Name, Location, and Description

The Rasmussen property, located in Green Oak Township, Livingston County, Michigan, consists of approximately 33 acres. The contaminated areas take up approximately one third of the Rasmussen property. Figure 1 is a map of the site location within the State of Michigan. It is bounded on the west and south by the Spiegelberg property, another Superfund site. A Rasmussen relative owns the property to the east, and Spicer Road follows the northern property line. The homestead located on the northern portion of the property is a Centennial Farm. Located next to the homestead is a small automobile body shop operated by the property owners. Although still largely wooded, the surrounding properties support some residential and agricultural development. All residences and small businesses have on-site drinking water wells, as there are no municipal water distribution systems in the vicinity. The residential well at the Rasmussen residence is approximately 250 feet from the leading edge of the contaminated groundwater contamination plume, and is in the direction of groundwater flow.

The legal description of the Rasmussen property is:

> Rasmussen property, Spicer Road, Livingston County, Michigan.
>
> Section 30, T1N, R6E, A NE 1/4 of NE 1/4, EXC E 262 feet thereof.

The site is located in an area of rolling hills that were deposited by glacial processes. Surface features include ponds and swampy areas to the south and east of the Rasmussen site. Soils consist of sands, gravel and clays underlain by Bayport Limestone of the Mississippian system. The sand and gravel deposits had been commercially mined, largely changing the original topographic contours. Investigations have shown that two glacial drift aquifers are present beneath the Rasmussen Dump site separated by a silt and clay confining layer .

The aquifer underlying the site is a Class I aquifer, as it is "(1) highly vulnerable to contamination because of the hydrological characteristics" and (2) characterized by groundwater that is irreplaceable (no reasonable alternative source of drinking water is available).

Site History and Enforcement Activities

The Rasmussen Dump, which accepted domestic and industrial wastes during the 1960's and early 1970's, forms a ridge-like crest across the southern portion of the site and property. Drummed and other industrial wastes were also disposed of at other locations on-site. Numerous incidents of burning were reported during the dump's operation. Several attempts were made by the

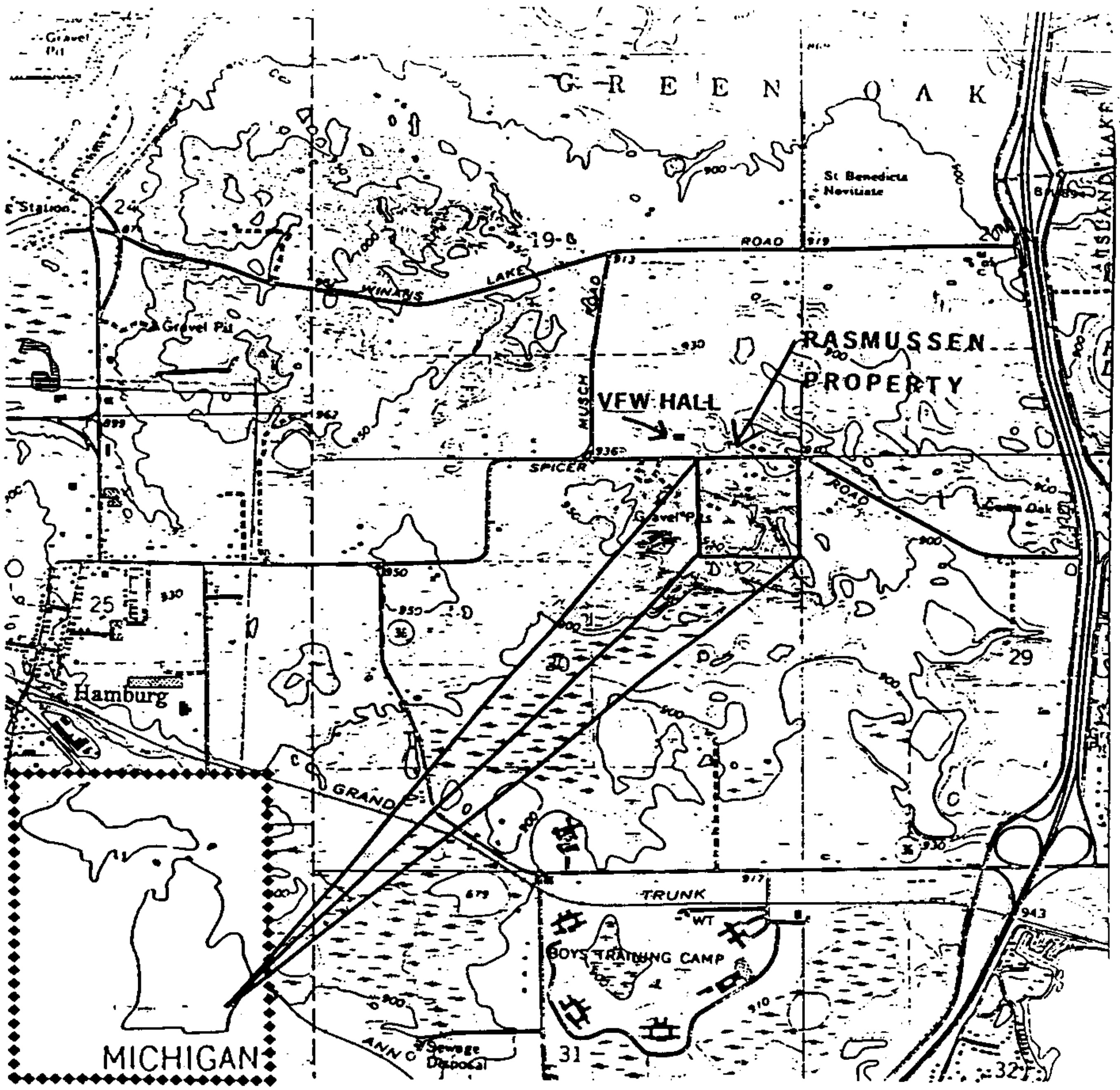

Figure 1 - Rasmussen Site

POOR QUALITY
ORIGINAL

county and state to bring the Rasmussen dump into compliance with State laws, but the dump was never properly capped and "closed" prior to termination of landfill operations in 1977. Sand and gravel mining, which began after closure in 1977, undermined the landfill and resulted in the redistribution of fill and drummed wastes.

Low levels of groundwater contamination were detected in a 1981 study conducted by the MDNR. U.S. EPA's Field Investigation Team conducted a site inspection in 1982, and the site was scored and placed on the Federal National Priorities List (NPL) of hazardous waste sites in 1983.

In October and November of 1984, the U.S. EPA Emergency Response Team removed roughly 3,000 drums and 250 cubic yards of contaminated soils from the top and south face of the dump. By December of 1984, a State-lead Remedial Investigation was initiated (U.S. EPA was the Support Agency). Late in 1985, MDNR constructed an eight-foot high chain-link fence around an area which had been determined to contain various organic chemicals, low level dioxins and PCBs.

The report of findings for the Remedial Investigation was issued in September of 1988. Based on the findings of the Remedial Investigation, the Agencies were able to delineate discrete areas of buried drums and contaminated soils. U.S. EPA issued an Administrative Consent Order, under Section 106(a) of CERCLA, for the removal of the drums, wastes, and associated visibly contaminated soils from three of the soils areas--the Northeast Buried Drum (NEBD) Area, Top of Landfill (TML) Area (although labeled a "landfill" in the RI, this dumping area was never a licensed fill), and Industrial Waste (IW) Area. Eleven PRPs signed the Order which became effective on August 24, 1989. This second removal action began in December of 1989.

Roughly 650 drums were unearthed and staged on-site pending disposal authority. Waste screening prior to disposal indicated that the contents of three drums contained waste with a pH of 12 or greater. Preliminary flammability screening indicated that approximately half of the containers may have contained flammable contents. PCB composites (5 drums per composite) showed levels as high as 270,000 ppm, while 80 percent of the composites showed detectable levels of PCBs. Eight containers were found to contain liquids. All excavated wastes were manifested as hazardous and transported to approved RCRA facilities. Figure 2 outlines the locations of each remaining area of concern on the Rasmussen site.

In June of 1987, the landowner sold approximately 7,000 cubic yards of contaminated soil (identified as "Ramsey Soil Excavation" on Figure 2) from the fourth area of concern--the Probable Drum Storage, Leakage, Disposal (PDSLD) Area. The State

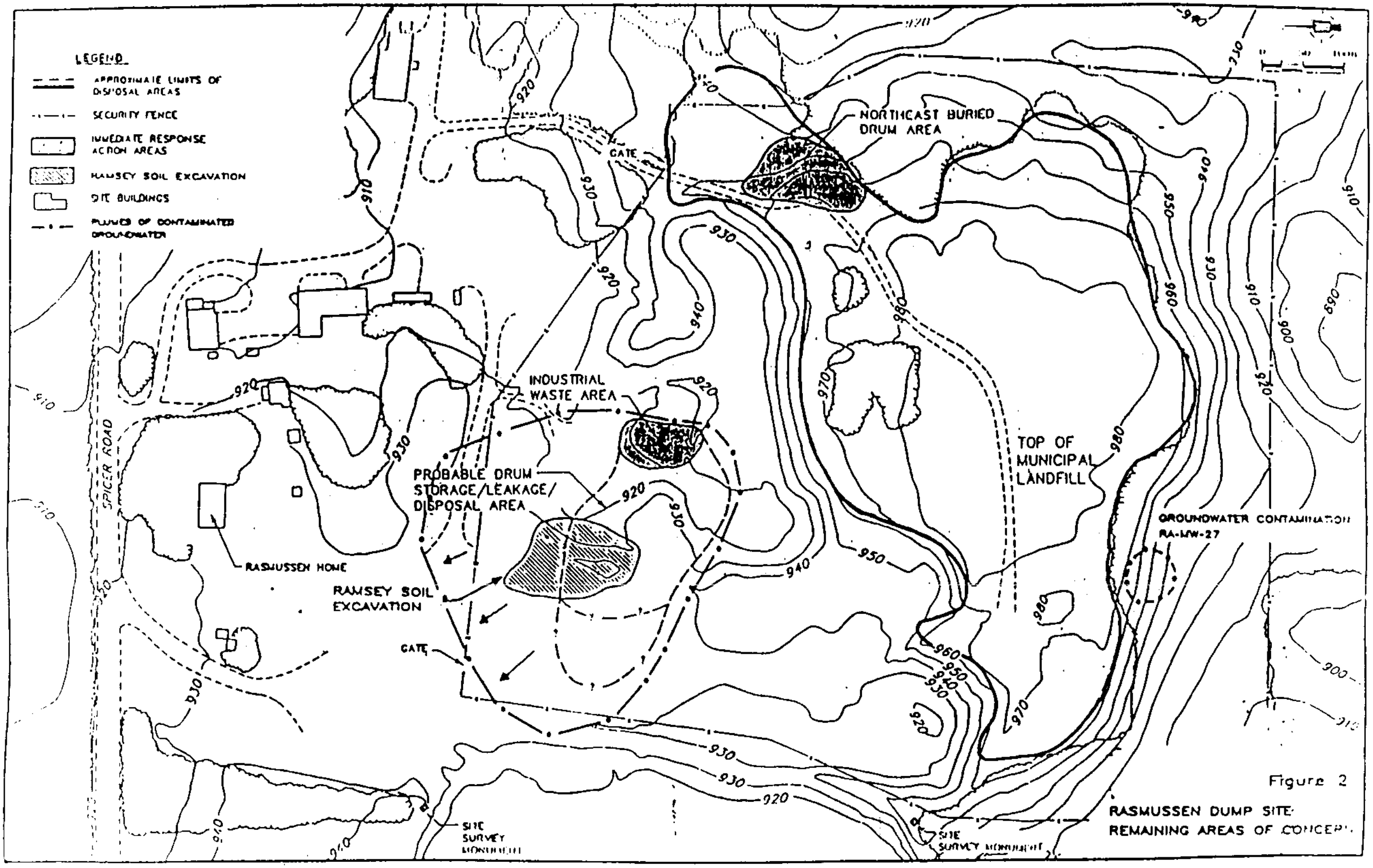

Figure 2

RASMUSSEN DUMP SITE
REMAINING AREAS OF CONCERN

obtained a temporary restraining order 1) against further movement of the soils, 2) for return of the soils by the landowner and the purchaser of the contaminated soils, and 3) for unrestricted access for the State and U.S. EPA to further their investigative activities (Civil Action No. 87-8917, Circuit Court, Livingston County). The soils were returned to the Rasmussen property, and the landowner and purchaser are required to repay portions of the State's costs incurred in pursuing this action.

The Feasibility Study Report, prepared by MDNR, reviewed by U.S. EPA, and released for public comment on January 16, 1990, is also based on the findings of Remedial Investigation and Risk Assessment Reports. Subsequent to the completion of the Feasibility Study, further soil boring investigations and analyses were conducted from December of 1989 through January of 1990, on the PDSLD Area. The results of these investigations are detailed in a Technical Memorandum, attached hereto as Appendix 3, and have been added to the Administrative Record.

Potentially Responsible Parties (PRPs) have been identified by U.S. EPA for the Rasmussen site. A General Notice Letter was issued to the identified PRPs in September 1988. Special Notice Letters will be issued to the PRPs after this Record of Decision has been signed.

Highlights of Community Participation

A complete chronology of community relation activities for the Rasmussen site is provided as part of the attached Responsiveness Summary. This past year's activities include the issuance of the Feasibility Study (FS) Report for the Rasmussen site on January 16, 1990. Site information including the FS have been and continue to be available to the public as part of the administrative record, which is housed at three information repositories: the EPA Docket Room for Region V, in Chicago, Illinois, and at both the Brighton City and the Hamburg City Libraries, near the site. The notices of availability of the Feasibility Study and Proposed Plan were published in the Brighton Argus, the Ann Arbor News, and the Detroit News/Free Press. A Proposed Plan detailing the Agency's preferred alternative was issued on August 31, 1990, initiating the public comment period. A public meeting was held on September 13, 1990 at the Green Oak Township Hall. The meeting included a drop-in availability session, a formal hearing, and an informal question and answer period. The availability session was held in the early afternoon. At that session MDNR and US EPA staff were available for informal discussion on the RI/FS, the Proposed Plan, or any other subject related to this site or the adjacent Spiegelberg Superfund site. The public hearing was held in the evening, and addressed comments on the Rasmussen site. An informal question and answer session for both sites followed the hearing. Responses to the comments received during the public comment period are included in the Responsiveness Summary, which is part of this Record of Decision.

Scope and Role of Response Action Within Site Strategy

Removal actions, as previously mentioned, have significantly reduced the quantity of containerized waste and contaminated soils at this site, permitting the final remedy, as described in this ROD, to address the remaining risks posed by the soil and groundwater contamination.

Summary of Site Characteristics

In September of 1988, the MDNR and U.S. EPA issued a Remedial Investigation Report for the Spiegelberg and Rasmussen sites. During the investigation, the areas of concern were identified as: 1) the Rasmussen groundwater plume, and 2) the four soils areas (PDSLD, IW, NEBD, TML). A Risk Assessment was also completed and issued as a separate document simultaneously with the Remedial Investigation Report. Specific contaminants detected in each area of concern are found in the Tabulations provided in Appendix 2. Appendix 3 presents the results of the supplemental soil investigation of 1989/1990. The Tables reflect pre-removal contaminant levels. Generally, both carcinogenic and non-carcinogenic compounds were found to be present in the Rasmussen soils and groundwater plume. To summarize:

* Drummed wastes were disposed of in an area referred to as the Top of the Municipal Landfill (TML). Periodic fires in this area may have been the source of the low levels of dioxins and dibenzofurans identified in this area. Soils not removed contained PCBs as high as 61 ppm. This is an area of concern due to the potential dermal threat posed by the PCBs and benzo(a)pyrene remaining in the surface soil, and the potential threat to groundwater from leaching of contaminants through the soils. Refer to Tables 2-5, 2-8 and 2-9 of Appendix 2 for contaminant levels found in this area. As mentioned, the majority of drummed wastes have been removed from this area. Surface soils in this area contain dioxins from the burning of wastes, averaging less than 1 ppb.

* The dump (TML) also consists of decomposed and non-degradable domestic trash, and some scrap metal. These wastes cover approximately 6 acres, and range from roughly 5 feet thick on the north edge, to greater than 50 feet thick on the south side. Post-removal observations have shown that scattered drums are partially buried in the dump and adjacent soils areas. Weathering and soil slumping continue to expose new drums.

* A buried drum area was intermingled with the municipal wastes in the northeast portion of the municipal landfill. This area is referred to as the Northeast Buried Drum (NEBD) area of concern. Drums, associated wastes, and contaminated soils located in the NEBD were found to contain high levels of volatile organic compounds, semi-volatile organic compounds and PCBs, and posed both a threat to groundwater and a dermal threat to humans. All drummed wastes have been removed from this area. Refer to the "Site History and Enforcement Activities" section for details of this removal. Refer to Table 2-14 of Appendix 2 for contaminant levels found in this area prior to the removal. This area currently poses a potential risk to groundwater from residual soil contamination.

* The Industrial Waste (IW) area is an area where mixed paint wastes and drums were found within the gravel pit at the center of the northern toe of the municipal landfill. Volatile organic constituents and PCBs characterized this area, presenting dermal and groundwater threats. Risks have been reduced by removal of drummed waste and some contaminated soils from this area, as previously discussed. Refer to Table 2-15 of Appendix 2 for contaminant levels found in this area prior to removal activities. This area continues to pose a potential threat to the groundwater resource from residual soil contamination.

* Testing of subsurface soils and recent gravel mining have revealed an area where leakage of drums and/or bulk disposal of liquid may have occurred. This area of concern is referred to as the Probable Drum Storage, Leakage, Disposal (PDSLD) area. Refer to Table 2-16 of Appendix 2 and Appendix 3 for contaminant levels found in this area. Limited investigations were conducted in this area during the RI. At the completion of the RI, data indicated that contamination existed in isolated lenses in the PDSLD unsaturated zone. The supplemental soils investigation of 1989/1990 gave a clear indication that the majority of contaminants are not being retained in the upper unsaturated soils, but have migrated through the upper soils in this area, and are now found either in the soils above the groundwater table, or in the groundwater itself. The contamination in the soils in this area is considered a current continuing threat to groundwater.

* The PDSLD/IW areas combined comprise roughly 9,400 cubic yards of varying degrees of contaminated soil above the groundwater table.

* The northern (and largest) groundwater contamination plume appears to have originated from the PDSLD/IW areas of concern. It is estimated to have traveled roughly 500 feet

in a north-northwesterly direction (Figure 2) and contains a large number of organic compounds. It is estimated that 3.3 million cubic feet of contaminated groundwater exists beneath the site. Groundwater flow rate is 173 feet per year in the upper aquifer and 204 feet per year in the lower aquifer. However, contaminants within the plume do not appear to be moving at the same rate as the groundwater.

* The groundwater in the vicinity of RA-MW-27 (southwestern toe of the dump) was confirmed to be contaminated with trichloroethene above groundwater cleanup levels. This confirmation was a result of re-evaluation of existing Remedial Investigation results and on subsequent PRP sampling events. Although limited in extent, this area requires remediation. Both areas of groundwater contamination are delineated on Figure 2.

* As noted above, the glacial aquifer used for water supply is presently contaminated by the Rasmussen plumes. Continued migration of the plumes poses a potential threat to water supply wells north and northwest of the site, although no wells beyond the site are presently contaminated by the plumes. Also considered is the fact that the groundwater at the site is potentially usable, and no reasonable alternative source of water exists.

* The actual or threatened release of hazardous substances from this site, if not remedied by the selected alternative, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Summary of Site Risks

The 1988 Remedial Investigation and Risk Assessment Reports detailed the site characteristics and risks prior to the 1989/1990 removal action, and without the benefit of information gained during the 1989/1990 supplemental soils investigation. Some of the site-specific details and assumptions used in the calculation of risk at that time differ from that which is characteristic of the Rasmussen site in its current state. The following discussion of the Rasmussen site risks describes the general concepts used in the RI and Risk Assessment to determine risk posed and chemicals of concern, and identifies those aspects of risk calculation that are still applicable after the removal and additional findings. Integrated with the discussions of current risks are discussions of groundwater chemicals of current concern and their corresponding cleanup levels, and the rationale for the soil remediation compliance points, in order to protect public health and the environment.

Human Health Risks

The following discussion of the Rasmussen site risk describes the general concepts used in the RI and Risk Assessment to determine chemicals of concern, risks posed by these chemicals, and impact on risks by the removal actions.

Contaminant Identification

As noted previously, Appendix 2 contains contaminant concentration summaries for the Rasmussen areas of concern, which were taken from the Risk Assessment. Appendix 3 contains additional information on the PDSLD, excerpted from the 1989/1990 Soils Investigation Technical Memorandum. Section 3-2 of the Risk Assessment describes the indicator chemical selection process and Table 3-1 in Appendix 4 here, lists the selected indicator chemicals for that assessment. The Risk Assessment tabulations represent the concentrations found during the Remedial Investigation samplings prior to the 1989/1990 removal of 650 drums and some associated soils. Contaminant concentrations reported in the Risk Assessment tabulations were a combination of surface soil and subsurface soil/waste samples. Many of the higher concentrations reported were from wastes found in close association with the drums in the NEBD, TML and IW areas, which have now been removed.

Exposure Assessment

The exposure assessment portion of the Risk Assessment identified the potential exposure pathways and receptors. Identified pathways and receptors were used in conjunction with assumptions of exposure frequency and duration, to model exposure point concentrations.

A. Pathways

Three factors were used to identify exposure pathways:

* Chemical source and release mechanisms to the environment.
* The environmental transport medium for the released chemical.
* The point of potential receptor contact with contaminated media.

1. Groundwater

During the performance of the Risk Assessment, risk calculations included factors for transport of chemicals from surface or subsurface waste deposits to the groundwater. These groundwater scenarios included direct percolation of liquid wastes and/or solubilization of solid or semi-solid wastes, and lateral transport of these wastes toward a receptor at Spicer Road. The average and maximum source concentrations of contaminants used to initiate these transport model calculations were often those taken from drummed waste, now removed from the IW, NEBD and TML areas.

The contaminants currently found in all four soils areas and groundwater now represent the source to the environment and human receptors, with the groundwater resource underneath each area of concern being the point of potential receptor contact--and not Spicer Road. The groundwater underneath the Rasmussen site is potentially usable, and thus requires protection and restoration. Likewise, based on existing hydrogeologic and chemical analytical data, contaminants currently in the groundwater, if not remedied, will migrate northward, eventually reaching the property boundary and may potentially impact existing or new wells.

The scenario for point of potential receptor contact with contaminated groundwater does not change based on prior removal actions. Potential receptors are likely to be exposed to contaminants in groundwater via normal domestic uses. With reference to risk, ingestion is the primary point of potential receptor contact. Inhalation of volatilized contaminants during showering or bathing is a secondary exposure route. Dermal absorption of organic compounds through water usage could also occur, but studies have shown this to be an insignificant exposure route in contrast to ingestion or inhalation.

2. Soils

As explained above, the soils areas were considered as potential sources of groundwater contamination in the Risk Assessment. Dermal contact with, accidental ingestion of, and inhalation of volatile organic contaminants and fugitive dust from surface soil contamination were also considered as pathways in the Risk Assessment. The Risk Assessment analyses found that due to very low concentrations of contaminants in RI air samples, routine release of contaminants through volatilization or fugitive dust is not significant. Particulate air monitoring conducted as part of the 1989/1990 drum excavation activities, during which a fair amount of soil and waste disturbance occurred, did not show elevated airborne contaminant levels. Contaminants remaining in these soils areas after removal, currently pose a reduced dermal contact risk from that which was assessed in the Risk Assessment. Appendix 4 attached provides the list of indicator chemicals from the Risk Assessment. The 1989/1990 supplemental soils investigation has shown that surface soils remaining in the PDSLD area do not pose a significant dermal or inhalation risk These results are included as Appendix 3.

The likelihood of persons coming in contact with the contaminated soils (direct contact or accidental ingestion) has been essentially eliminated by the eight-foot high chain link fence, topped with three strand barbed wire, constructed around all soils areas of concern during 1985.

The remaining risk posed by the soil areas of concern, listed in Table 3-6 of Appendix 5, is primarily via their current potential contribution to the site's groundwater contamination through percolation or by interaction with the fluctuating groundwater interface. Specifically, the PDSLD/IW area poses a current risk to groundwater due to the presence of soil contaminants in close association with the groundwater, as indicated by the supplemental soils investigation results in Appendix 3. The TML and NEBD contaminated soils that remain also present a potential risk to groundwater.

B. Potentially Exposed Populations

For the purposes of the ingestion scenario exposure assessment, people who now, or will at sometime in the future, reside in the downgradient direction of groundwater flow (north-northwest) were considered potential receptors. Analysis of groundwater samples collected during the RI and in May/June 1990 indicate that the groundwater contamination plumes have not migrated beyond the site boundary, and that residential wells belonging to potential receptors are currently unaffected by the Rasmussen groundwater contamination plumes. As noted previously, the Rasmussen residential well, located approximately 250 feet distant from the leading edge of the plume, is the closest currently existing potential receptor. Other currently existing potential receptors within one mile of the site in the downgradient direction are limited to roughly 5 households and one VFW Hall.

For purposes of assessing the risk posed by the direct contact with or inhalation of contaminants from soils and wastes, persons who would be trespassing within the confines of the fenced area, or who would potentially be exposed through the occupational scenario, were considered potential receptors.

The property immediately to the north of the Rasmussen site is zoned residential, and a developer is currently pursuing options for building. Assessment of potentially exposed populations for the future scenario includes the potential use of the groundwater resource at the Rasmussen site. As will be explored in detail further on, this is the basis for the chosen groundwater and soil remediation.

C. Exposure Estimates and Assumptions

As previously noted, portions of the models and assumptions used in the Risk Assessment to calculate exposure point considerations are not characteristic of current site conditions. They reflect conditions prior to the removal and investigation done in 1989 and 1990. Other assumptions used are standard to all risk assessments and are still applicable to current site conditions. This section describes models and assumptions used, and indicates which are applicable to pre- and post- removal action scenarios. For complete details of exposure assessment and risk characterization results see Sections 3.4 and 3.5 of the Risk Assessment document.

1. Modeling Concepts

The Linkage Model, in conjunction with the Organic Leachate Model (OLM) and the Vertical and Horizontal Spreading (VHS) Model were used in the Risk Assessment to predict groundwater contaminant concentrations at a hypothetical receptor on Spicer Road, which forms the downgradient boundary of the site. Worst-case and realistic-case dose estimates were generated using measured waste concentrations, modeled leachate concentrations, an unsaturated and saturated zone linkage model, and an EPA-approved groundwater transport model. In addition to the modeled leachate concentrations, existing groundwater contaminant concentrations in the identified plume were also used to estimate risks at the same receptors.

Modeling for exposure to soils contamination was assessed using both worst-case and plausible-case scenarios for the hypothetical cases of contact through trespass and inhalation of contaminated air or fugitive dust.

2. Contaminant Concentrations

The OLM in conjunction with the VHS Model was used to estimate the contaminant concentration in the groundwater due to leaching through the soil. From there, the leachate concentration of a particular contaminant was derived using a linkage model. This model is a one-dimensional screening tool that does not account for contaminant density, co-solvent transport, or colloidal transport. The model assumes that the source of contamination is steady (i.e., not a pulse input such as a single spill) and that contaminant movement occurs only in the vertical direction in the unsaturated zone and only in the horizontal direction in the saturated zone. Upon calculating a contaminant concentration in the saturated zone, a concentration at a selected receptor (in this case, a hypothetical, shallow domestic well installed near Spicer Road, the downgradient boundary of the site, can be estimated. The model mathematically simulates the migration of contaminated groundwater to a point of exposure. The contaminant concentrations calculated for the site, based on the leaching of contaminants through the soil to the groundwater (as described above), and used to derive risk, are not necessarily characteristic of the current Rasmussen site conditions since the concentrated wastes in the NEBD, IW and TML areas have been removed.

In order to protect human health and the environment, under CERCLA and the NCP, cleanup levels have been established for the site. Given the close proximity of residential wells and the potential future use of the groundwater, risk-based cleanup levels have been established for groundwater. These cleanup levels were used to determine the need for remediation of the existing groundwater contamination. These cleanup levels are consistent with "Type B" cleanup criteria in Michigan Act 307. Michigan Act 307 cleanup criteria are discussed further below.

Cleanup levels have also been established, under CERCLA and the NCP, for the contaminated soil areas at the site. The objective for the soil remediation is to reduce the contaminant levels in the soils to that level which will not leach contaminants above the groundwater cleanup levels. As such, the cleanup levels set for groundwater also provide the basis for the soil remediation. These cleanup levels are also consistent with the cleanup criteria in Michigan Act 307 (R299.5711(2)) which is discussed further below.

For soils, the direct contact scenario used maximum and average source concentrations for the worst-case and plausible-case scenarios. These concentrations were moderated by factors for adsorption and soil adherence.

Worst-case scenarios for air use maximum contaminant concentrations, with a soil disturbance frequency of 30 days per month and zero vegetative cover, while the plausible-case scenario uses the arithmetic average of soil concentrations, with a disturbance frequency of 10 days per month and a 50 percent vegetative cover.

3. <u>Dose and Exposure Scenarios</u>

Dose is used in the modeling of risk and is defined as the amount of a compound, in milligrams (mg), absorbed daily, by a receptor, per kilogram (kg) of body weight. Doses can be calculated for a lifetime (for carcinogenic effects, or for one-time acute exposures (for noncarcinogenic effects).

The factors which influenced groundwater ingestion dose are contaminant concentration (maximum or average), ingestion rate, the fraction of contaminant absorbed, and body weight. The groundwater ingestion rate used for this site was based on the standards of 2 liters/day for a 70-kg adult receptor and the absorption fraction was 100 percent (1.0) for all groundwater contaminants.

Groundwater inhalation dose considers the following factors: volatile generation rate, inhalation rate, body weight, air exchange rate, shower duration, and total duration in bathroom. The inhalation rate used was 20 liters/min, for a 70-kg receptor, and the air exchange rate was 8.3E-03 min^{-1}. The shower duration and total exposure duration were set at 15 minutes and 20 minutes, respectively.

The assumptions used in the groundwater dose calculations are standard and applicable to current site conditions.

Doses for the dermal adsorption route of exposure are calculated using contaminant concentration, area of skin exposed, fraction of contaminant adsorbed, soil adherence per unit area, exposure duration, and body weight. Receptor body weights used were either 50 kg for youths or 70kg for adults. Worst-case estimates employed a 30-day exposure period for 40 years and the plausible-case scenario was calculated using 10 days for 40 years. Exposure duration over a lifetime is a factor in calculating doses and risks from carcinogenic exposure. Noncarcinogenic exposure uses a comparison between maximum daily dose and the applicable health standard.

Conservative assumptions used in modeling dose from the inhalation of emissions from source areas included use of on-site contaminant concentrations to represent downwind concentrations. Calculations of these doses also factored in inhalation rates, fraction of contaminant adsorbed, exposure duration, and the receptor's body weight. Inhalation rate was set at 20 cubic meters per day, and it is assumed that 100 percent of the volatile compounds and only 20 percent of the inorganic compounds is adsorbed. Both maximum and arithmetic average soil concentrations were used to generate worst-case and plausible case exposure scenarios, respectively.

The estimates made for the exposure scenarios are the best representation of the site conditions at the time of the Remedial Investigation.

<u>Toxicity Assessment</u>

The toxicological evaluation characterizes the inherent toxicity of the chemicals. It consists of a review of scientific data to determine the nature and extent of the human health and environmental hazards associated with exposure to the various chemicals. Subsections A. and B. immediately below discuss the concepts of cancer potency factors (CPFs) and reference doses (RfDs) as they are typically employed in the risk assessment process. A site-specific discussion of contaminant toxicity and the applicable Appendices is included in the "Risk Characterization" section below (subsections B. and C.).

A. Cancer Potency Factors

Cancer potency factors have been developed by EPA's Carcinogenic Assessment Group, for estimating the lifetime probability of human receptors contracting cancer as a result of exposure to known or suspected carcinogens present in site media. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays, to which animal-to-human extrapolation and uncertainty factors have been applied. CPFs are expressed in units of $(mg/kg\text{-}day)^{-1}$. CPFs are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. The use of CPFs is in accordance with U.S. EPA's guidance for establishing carcinogenic risk.

B. Reference Doses

Reference doses have been developed by EPA (and MDNR in the case of 0.0004 mg/kg-day for lead) for indicating the potential for adverse health effects from chronic and or sub-chronic human exposure to chemicals exhibiting noncarcinogenic effects. RfDs, expressed in units of mg/kg-day, are estimates of lifetime daily chemical exposure levels for humans, including sensitive individuals, that are likely to be without an appreciable risk of adverse noncarcinogenic health effects. RfDs are derived from human epidemiological studies or animal studies, to which uncertainty factors have been applied, to account for the use of animal data to predict effects on humans. These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD.

Risk Characterization

The following section describes the process used in the Risk Assessment to estimate the potential incidence of adverse health or environmental effects under the exposure scenarios defined in the above section.

A. Uncertainty in Risk Assessment

Carcinogenic and noncarcinogenic health risks are estimated using a number of different assumptions. The extent to which health risks can be characterized is primarily dependent upon the accuracy with which a chemical's toxicity can be estimated and the accuracy of the exposure estimates. The toxicological data that form the basis for all risk assessments contain uncertainty in the following areas:

* The extrapolation of non-threshold (carcinogenic) effects from the high doses administered to laboratory animals to the low doses received under more common exposure scenarios.

* The extrapolation of the results of laboratory animal studies to human or environmental receptors.

* The inter-species variation in toxicological endpoints used in characterizing potential health effects resulting from exposure to a chemical.

* The variations in sensitivity among individuals of any species.

Exposure estimates presented for groundwater are based on a number of simplifying assumptions, including the following:

* A contaminant is leached from soil and waste materials according to the relationship between its environmental concentration and its solubility, as defined by the Organic Leaching Model.

* Solubilized contaminants are transported along with the normal groundwater flow. They reach a receptor at any defined distance from the source at a concentration proportional to the source concentration, as defined by the VHS Model.

* Physical and chemical characteristics of site soils and groundwater such as retardation, solubilities, partitioning coefficients, and colloidal effects, are not necessarily considered.

* Receptor characteristics, such as age, body weight and exposure duration, are based on published values, with some attempt at making them more site-specific (eg. known duration of site use by ORVers).

For soils the main simplifying assumption for assessment of risk is that contaminants are transported along with air currents or as particulates, with wind direction and velocity, and are not dispersed en route to the receptor.

For all exposure scenarios and all media, the chemical analytical data base is limited by sample locations and sample frequency. Every effort is made to collect samples that reflect actual site conditions, but not every portion of the site can be sampled.

The following sections on carcinogenic and noncarcinogenic risk are provided as a description of how risk is characterized, and the Rasmussen Risk Assessment numbers generated prior to the removal and sampling of 1989 and 1990 are used as examples. It should be noted that the receptor concentrations used in the assessment are based on the leaching of chemicals from wastes prior to them being removed from the site in 1989/1990. The chemicals of concern noted in the Risk Assessment and Feasibility Study were based on conditions prior to the 1989/1990 removal. The groundwater chemicals of concern listed in Table 1 are for contaminants found in the groundwater at concentrations above health-based levels or taste and odor considerations (discussed further on), that currently exist at the site.

B. Carcinogenic Risks

Carcinogenic risks can be estimated by combining information in the dose-response assessment (carcinogenic potency factors) with an estimate of the individual intakes (doses) of a contaminant by a receptor. The resulting number (risk) is an expression of an individual's likelihood of developing cancer as a result of exposure to the carcinogenic indicator chemicals. This likelihood is in addition to the risks incurred by everyday activities. For example, a risk of 1E-06 is applied to a given population, to determine the number of excess cases of cancer that could be expected to result from exposure. The figure of 1E-06 is one additional case of cancer in 1,000,000 exposed persons.

For purposes of the groundwater risk evaluation, the Agencies considered a hypothetical shallow aquifer residential well, installed at the Spicer Road property boundary. The movement of contamination with the groundwater was modeled under several scenarios. The four scenarios presented in the Risk Assessment included using both the maximum and arithmetic average subsurface soil source concentrations, each with 1 meter and 10 meter values of transverse dispersivity (lateral movement) in order to present a range of potential risk. The total predicted carcinogenic risks (includes both an ingestion and inhalation component) from potential routine use of contaminated groundwater generated on-site for the four scenarios are listed in Table 3-6 of the Risk Assessment attached as Appendix 5 to this ROD. The Rasmussen groundwater plume as well as the four soils areas are included. Tables 3-7 and 3-9 of Appendix 5 show the carcinogenic risk from the soils areas as they pertain to the exposure scenarios of dermal contact and inhalation of fugitive dust.

TABLE 1 - CARCINOGENIC RISK AND GROUNDWATER CLEANUP LEVELS FOR THE RASMUSSEN SITE

CHEMICAL	MAX. CONC. FOUND (ppb)	CARC. RISK W/ MAX CONC.	CLEANUP LEVEL (ppb)	BASIS	CARC. RISK W/ CLEANUP LEVEL
acetone	26,000.0		700.0	HLSC	
benzene	700.0	5.8E-04	1.2	1E-06	1.0E-06
bis(2-ethylhexyl)phthalate	12.0	4.8E-06	2.0	1E-06	1.0E-06
2-butanone	74,000.0		350.0	HLSC	
cadmium	29.0		4.0	HLSC*	
chlorobenzene	3,700.0		50.0	T&O	
2-chlorophenol	17.0		5.0	T&O	
1,1-dichloroethene	2.0	3.4E-05	1.0	MDL	1.7E-05
1,2-dichloroethene	590.0		100.0	HLSC	
ethylbenzene	2,400.0		30.0	T&O	
isophorone	440.0	4.1E-05	8.0	1E-06	1.0E-06
lead	779.0		5.0	HLSC*	
2-methyphenol	1,600.0		300.0	T&O	
4-methyl-2-pentanone	30,000.0		350.0	HLSC	
methylene chloride	1,100.0	2.2E-04	5.0	1E-06	1.0E-06
toluene	71,000.0		40.0	T&O	
1,1,1-trichloroethane	500.0		200.0	MCL	
trichloroethene	774.0	2.3E-04	3.0	1E-06	1.0E-06
vinyl chloride	96.0	6.2E-03	1.0	MDL	7.0E-05
xylenes	11,000.0		20.0	T&O	

TOTAL CARCINOGENIC RISK FROM CONTAMINANTS CURRENTLY IN GROUNDWATER = 7.3E-03

TOTAL CARCINOGENIC RISK FROM CONTAMINANTS AT CLEANUP LEVELS = 9.2E-05

Key to Basis of Cleanup Levels

MDL = Method Detection Limit
MCL = Maximum Contaminant Level
1E-06 = One in One Million Carcinogenic Risk Level
T & O = Taste and Odor Threshold
HLSC = Human Lifecycle Safe Concentration
HLSC* = HLSC or Filtered Background (whichever is higher)

The carcinogenic risks associated with the maximum groundwater concentrations are listed in Table 1 of this ROD.

Major contributing chemicals to the carcinogenic risks from dermal contact with site soils are as follows: PCBs and benzo(a)pyrene for the TML; PCBs for the IW; PCBs for the PDSLD; and dioxins for the NEBD. As noted previously, the drummed wastes and associated contaminated soils have now been removed from the IW, NEBD and TML areas of concern. Remediation of these soils areas is, however, necessary for mitigation of the potential risk posed by the contaminated soils areas to groundwater, as noted in Table 3-6 of Appendix 5.

The 1989/1990 supplemental soils investigation, included as Appendix 3, showed the presence of contaminated soils in the PDSLD which are a current source of groundwater contamination. These findings provided more detail with regard to the threat posed by the PDSLD soils.

Even under the worst-case scenario, the risks from potential fugitive dust emissions do not exceed 1.56E-07. This is shown in Table 3-9 of Appendix 5. Potential inhalation of ambient air from the combination of the Spiegelberg and Rasmussen sites prior to the 1989/1990 source control removal activities, in the worst-case scenario, produces a total carcinogenic risk of 4.1E-06. An explanation of inhalation risk calculation can be found above in the section entitled "Dose and Exposure Scenarios".

C. <u>Noncarcinogenic Risk</u>

Potential health risks resulting from exposure to noncarcinogenic compounds are estimated by dividing the maximum daily dose exposure by the Reference Dose (RfD), to obtain the Hazard Index. If the Hazard Index exceeds one, there is a potential health risk associated with exposure to that particular chemical. The Hazard Index is not a prediction of the severity of toxic effects, but simply a numerical indicator of the transition from an acceptable to unacceptable levels. The total Hazard Index for an exposure route is the sum of all Hazard Indices for each individual chemical. Hazard Indices were determined for the existing Rasmussen groundwater plume as noted in the Risk Assessment Table 3-11 and included in Appendix 6 here. Hazard Indices were greater than one for the groundwater plume itself, and for worst-case scenario for the NEBD in the pre-removal hazard assessment. The Hazard Index Tables for the direct dermal contact and the fugitive dust emissions scenarios are included in Risk Assessment Tables 3-12 and 3-14, and attached as Appendix 6 here. None of the direct dermal contact or fugitive dust emission Indices exceeded one.

Environmental Risk

Over and above its utilitarian value to humans as a usable aquifer, the groundwater is a resource to be evaluated as are all other environmental compartments and life forms. Based on the findings of the Remedial Investigation, a portion of the on-site groundwater at the Rasmussen site has been degraded and poses the potential for degrading more of the downgradient resource, if not remediated. The prevention of further degradation of the presently contaminated groundwater resource is an environmental remedial objective that needs to be addressed by any remedy chosen for the Rasmussen site.

Also evaluated for environmental risk from groundwater contamination were air, soil, surface waters, and terrestrial and aquatic biota. None of these potential environmental receptors were determined to be at risk from the Rasmussen site.

Based on reports of citizen's complaints early in the Rasmussen site's history, burning wastes and reports of odors may have been indicative of air releases at that time. Through recent sampling efforts, air releases have not been found to pose a risk at the Rasmussen site.

No hydrologic connection was found to exist between the site's source areas and the area's surface waters. The Huron River is about a mile and one half north of the contaminated portion of the site. The Spiegelberg peat pond to the south and several low areas to the north and east are the only surface water features located near the site. Assessment of these features showed them to be uncontaminated, and not hydrologically connected to the waste areas on the site.

One threatened species, the Eastern Sand Darter (Ammocrypta pellucida) (a member of the perch family), and one special concern species, the Dwarf Hackberry (Celtis tennifolia), were identified as inhabiting environs near the site. Although terrestrial flora and fauna which live within or traverse the site may come in contact with contaminated surface soils, environmental toxicologists have noted that if contamination is addressed to protect for human health, potential risks to wildlife would be addressed as well.

No critical habitats have been threatened by the contamination at the Rasmussen Site.

Chemicals of Concern and Cleanup Levels

Chemicals of concern were determined for the Rasmussen groundwater plume. The basis for the selection of the 20 chemicals of concern (noted in Table 1), are those detected at levels in Remedial Investigation sample data, and which pose a potential risk to human health and the environment. The Chemicals of Concern pose a potential risk by either exceeding the level for the 1E-06 carcinogenic risk, by exceeding the level for Human Lifecycle Safe Concentrations (HLSCs), or by exceeding an aesthetics level. The basis for the selection of these cleanup levels is provided in CERCLA Section 121 and the NCP. In order to protect human health and the environment, under CERCLA and the NCP, risk-based cleanup levels have been established for groundwater. A risk-based cleanup is necessary due to the close proximity of residential wells and the potential future use of groundwater at and near the site. These cleanup levels are consistent with "Type B" cleanup criteria in Michigan Act 307 and the Michigan Act 307 Rules (R299.5705, 707, 709, 717).

The chemicals which have cleanup levels based on the 1E-06 carcinogenic risk for the existing groundwater plume are: benzene, bis(2-ethylhexyl)phthalate, isophorone, methylene chloride, and trichloroethene. These chemicals are known to cause cancer in laboratory animals, and thus are classified as carcinogens.

Two carcinogens, 1,1-dichloroethene and vinyl chloride have carcinogenic risk levels which are lower than what can be detected by current laboratory methodologies. These chemicals have cleanup levels set by their respective method detection limits (MDLs).

A second group of chemicals of concern at this site are classified as noncarcinogens and are believed to exert their toxicity by a threshold mechanism of action. The HLSCs, which were developed for the noncarcinogens, are based on this concept. The HLSCs represent the highest groundwater concentration to which a human can be exposed continuously, for a lifetime, without exhibiting any observable adverse health effects. Cleanup levels for six chemicals were set in this manner: acetone, 2-butanone, cadmium, lead, trans-1,2-dichloroethene, and 4-methyl-2-pentanone.

Unfiltered samples analyzed during the RI were found to exceed the HLSC calculated for lead and cadmium. There may be reason to believe that dissolved levels of lead and cadmium will not exceed background dissolved concentrations. Therefore, the HLSC groundwater cleanup level noted in Table 1 is starred (*). This indicates that a determination will be made as a result of design studies. If 1) filtered lead and cadmium samples are less than 5.0 ppb and 4.0 ppb, respectively; or if 2) on-site filtered lead and cadmium samples are greater than 5.0 and 4.0 ppb, respectively, and on-site filtered lead and cadmium levels are equal to or than their corresponding filtered background samples, then cleanup for these chemicals of concern will not be required.

Where insufficient data exist to calculate HLSCs for noncarcinogens, or where aesthetic data indicate that the chemical can still be detected either by taste or smell at the HLSC level, the literature-derived Taste and Odor (T&O) threshold is used as the cleanup level. The cleanup levels for chlorobenzene, ethylbenzene, 2-methylphenol, toluene, and xylenes are based on taste and odor thresholds.

One noncarcinogen, 2-chlorophenol, has a taste and odor threshold below what can be reliably detected. Therefore, the cleanup level for 2-chlorophenol is set at the MDL.

Summary of Risks

Although no individuals are directly ingesting contaminated groundwater from the Rasmussen site, the contamination could pose a health risk to potential receptors in the future. A significant amount of contaminated groundwater currently remains on site and is expected to continue to migrate towards downgradient wells, thereby creating potential exposure routes for human receptors. The future possibility exists, as well, for groundwater use at the site. In order to protect public health and the environment, remediation of the groundwater resource is necessary. The NEBD, TML, and IW soils areas of concern pose potential risks to the groundwater resource, while the PDSLD area poses a current risk to the groundwater. Remediation of these four soils areas is necessitated by the risks posed to groundwater.

Potential risks from direct dermal contact or from inhalation of airborne contaminants, when modeled, do not pose significant risk to human health.

Actual or threatened releases of hazardous substances from the Rasmussen site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

Description of Alternatives

Alternatives Screening Process

Initially, the Feasibility Study considered all potential alternatives for remediation of the Rasmussen site. Subsequent preliminary and detailed screening left only a limited number of alternatives, in part due to ARARs which restricted remedial options because of waste types and concentrations present.

The reader is directed to Tables 6-6, 6-7, 6-8 and 6-9 in Volume III (and associated text in Chapter 6) of the Feasibility Study Report, for the detailed screening of the PDSLD, IW, NEBD, and

TML soils areas, respectively. The alternatives remaining after detailed screening of the TML soils area of concern were clay and multi-media capping, and on-site incineration. The detailed screening of alternatives for the Rasmussen groundwater plume area of concern is described in Chapter 7 of the Feasibility Study Report and is supported by Tables 7-1, 7-3, and 7-4 in that report.

In the subsequent evaluation of incineration versus capping, cost and dioxin disposal were the two major considerations. The large volume and the variability of the waste contained in the dump make incineration an extremely costly (over $100 million) option. Dioxins were found in the TML, but on average were below 1.0 ppb, the level which may trigger further action (Kimbrough et.al., 1984). However, the presence of dioxins increases the short-term inhalation risk to workers and community for alternatives which involve excavation (due to fugitive dust emissions). The implementability of the off-site disposal option is limited at best, as no landfills in the United States accept dioxin-containing wastes and no vendors were found to treat this waste type.

Since liquids and other concentrated industrial wastes have been removed from the NEBD, IW and TML by EPA and the PRPs, the capping alternative is enhanced.

U.S. EPA guidance provides for the combination of medium-specific alternatives during the detailed analysis phase of remedy selection. If comprehensive options are found to address all potential site threats, then the Agency may propose site-wide remedial alternatives. Remedy selection in the Feasibility Study anticipated completion of the removal actions, and the site-wide alternative was proposed as a remedy. Chapters 8 and 9 of the Feasibility Study describe the transition from the comprehensive list of alternatives to the site-wide alternatives.

As part of the combination of alternatives, the process options evaluated in the detailed screening of alternatives for the Rasmussen groundwater were combined to develop a site-wide action alternative for the contaminant plume. Page 8-5 of Volume I of the Feasibility Study describes the combination of groundwater remedial alternatives.

Subsequent to the completion of the Feasibility Study, a supplemental soils investigation in the PDSLD, completed in early 1990, provided additional information as to the nature and extent of the contamination in this area and led to differing conclusions with regard to the preferred alternative. The Remedial Investigation led the Agencies to conclude that soils, particularly in silty lenses throughout the unsaturated zone in the PDSLD, were contaminated with PCBs and other organic contaminants. Based on these facts, remedy selection efforts

were focused on actions which would prevent the contaminants, shown to be in the intervening PDSLD layers, from migrating to the groundwater, while providing a level of protectiveness for the other three soils areas of concern. Excavation and capping options were explored along with the non-excavation and capping options. The accompanying groundwater remedy included re-injection of treated groundwater via recharge wells rather than seepage basin reintroduction, due to the lack of space remaining if the soils capping remedies were implemented. Recharge wells were found to be less costly than seepage basins, when used purely for the reintroduction of treated water.
The 1989/1990 supplemental soils investigation of the PDSLD showed that the following conditions exist in this area:

* The unauthorized sand and gravel mining from this area in 1987 had taken with it some contaminants from the unsaturated soils.

* No PCBs were determined to exist at depth in the PDSLD.

* PCBs were not found in the PDSLD soils at concentrations significantly exceeding 1 ppm.

* Contaminants such as chlorobenzene, ethylbenzene, toluene, xylenes, 1,2-dichlorobenzene, and 1,3-dichlorobenzene were found to be within the 25-foot zone above the water table in the PDSLD. Contaminant levels were highest at or near the water table.

* Contaminants such as 1,1,1-trichloroethane and tetrachloroethene were distributed throughout the soil in the PDSLD, but in concentrations below health-based risk levels.

Although capping options were retained for the soils areas of concern as the best overall option and groundwater purge and treat was retained for treatment of the groundwater plume, modifications were made to tailor the options based on the new information. Modifications include:

* The cap would not be effective in containing the remaining contamination in the IW and PDSLD areas since it is concentrated in the soil profile just above the water table, and would continue to be a source of contamination to the groundwater as the water table fluctuated. Direct contact with the surface soils of the PDSLD and IW areas is no longer a concern, so the cap would not be necessary for those areas. The cap should cover the TML including the NEBD, to prevent further infiltration, and direct contact with contaminants.

* Reintroduction of treated groundwater could now be achieved more cost effectively through seepage basins, since this system, when located above the IW and PDSLD areas, will serve the dual purposes of 1) reintroduction of treated groundwater and 2) flushing of contaminants through the unsaturated zone to the groundwater, and toward the extraction wells. This will create a closed-loop groundwater treatment system.

These considerations resulted in different cost estimates and remedy descriptions in the Proposed Plan than were presented in the Feasibility Study. Capping cost estimates (below) have been modified some since the issuance of the Feasibility Study to more accurately reflect the amount of material required for each cover type and areal extent. The groundwater cost estimate has also changed to include seepage basins instead of injection wells. Cost estimates do not reflect any future drum disposal which may be required. Drum removal will add roughly $1,000 per container to the overall cost of each of these options. However, costs are comparable for all of the capping alternatives.

Design studies show that for all of the capping options considered, the Rasmussen cap will extend onto the Spiegelberg property. This is necessitated by cap design criteria involving slope for drainage and erosion control. Terracing may be designed into the selected alternative to control the overflow onto neighboring properties.

Description of Site-wide Alternatives

The site-wide remedial alternatives described below, were evaluated in the Feasibility Study as Alternatives 1 through 7--with Alternative 1 being the No Action Alternative for the soils areas; Alternatives 2 through 5, variations on the in-place capping alternative; Alternative 6, the No Action Alternative for groundwater; and, Alternative 7, a Treatment Alternative for groundwater. Alternatives 8 and 9 in the Feasibility Study are pertinent to the neighboring Spiegelberg site, and are therefore not addressed in this ROD.

Soils

Site Wide Alternative 1 - NO ACTION.

Under this scenario, no further remedial measures would be taken for the four soils areas of concern to prevent potential exposure to, or migration of the contaminants in the unsaturated zone soils to the groundwater. Risks currently posed by the contaminated groundwater are expected to increase under this No Action scenario. Although the site is currently fenced, the potential for direct contact with contaminated surface soils is not completely eliminated, and the No Action Alternative does nothing to reduce the potential for direct contact with these soils.

Implementation Time:	None.
Capital Cost:	$ 0
Annual Operation and Maintenance (O&M):	$ 0
Total Costs w/ 1 Year O&M:	$ 0

Site Wide Alternative 2 - Clay cap with no further excavation and restricted access.

Under this alternative, a Michigan Act 64 cap with a 3-foot thick clay layer, a minimum of one-foot thick drainage layer and a one-foot thick vegetated soil layer would be constructed over the combined TML and NEBD areas of concern. The IW and PDSLD areas need not be covered, but may be partially covered in order to provide adequate north-face slopes for the two capped areas. Access restrictions, such as fencing, would be placed around the capped soil areas. Deed restrictions would be instituted to prevent future land use. Drums which are currently visible, or which are unearthed during cap implementation, will be disposed of in accordance with applicable Federal and State regulations.

Implementation Time:	1 to 2 years.
Capital Cost:	$ 2,940,247
Annual Operation and Maintenance (O&M):	$ 53,043
Total Costs w/ 1 Year O&M:	$ 2,993,290

Site Wide Alternative 3 - Clay cap with further excavation and restricted access.

Under this alternative, the PDSLD area would be excavated and consolidated alongside the north face of the dump. A clay cap (as described in Alternative 2) would then be constructed over the consolidated areas. Access restrictions, such as fencing would be placed around the capped soil areas. Deed restrictions would be instituted to prevent future land uses. Drums which are currently visible, or which are unearthed during cap implementation, will be disposed of in accordance with applicable Federal and State regulations.

Implementation Time:	1 to 2 years.
Capital Cost:	$ 4,486,019
Annual Operation and Maintenance (O&M):	$ 53,043
Total Costs w/ 1 Year O&M:	$ 4,539,062

Site Wide Alternative 4 - Multi-media cap with no further excavation and restricted access.

Under this alternative, a multi-media RCRA-type cap with 1) a 12-inch thick vegetated soil layer on top, 2) a 12-inch thick drainage layer, 3) a synthetic liner at least 20 milliliters thick, and 4) a 2-foot thick layer of compacted clay with a permeability of 1E-07 cm/sec or less would be constructed over the TML and NEBD areas of concern as they now exist spatially on-site. Access restrictions, such as fencing, would be placed around the capped soil areas. Institutional controls, such as deed restrictions, would be instituted to prevent future land uses. Drums which are currently visible, or which are unearthed during cap implementation, will be disposed of in accordance with applicable Federal and State regulations.

Implementation Time:	1 to 2 years.
Capital Cost:	$ 4,946,285
Annual Operation and Maintenance (O&M):	$ 200,000
Total Costs w/ 1 Year O&M:	$ 5,146,285

Site Wide Alternative 5 - Multi-media cap with further excavation and restricted access.

Under this alternative, the PDSLD area would be excavated and consolidated alongside the north face of the landfill. A multi-media RCRA-type cap with 1) a 12-inch thick vegetated soil layer on top, 2) a 12-inch thick drainage layer, 3) a synthetic liner at least 20 milliliters thick, and 4) a 2-foot thick layer of compacted clay with a permeability of 1E-07 cm/sec or less would be constructed over the consolidated areas of concern as they now exist spatially on-site. Access restrictions, such as fencing, would be placed around the capped soil areas. Institutional controls, such as deed restrictions, would be instituted to prevent future intrusive land uses. Drums which are currently visible, or which are unearthed during cap implementation, will be disposed of in accordance with applicable Federal and state regulations.

Implementation Time:	1 to 2 years.
Capital Cost:	$ 6,491,669
Annual Operation and Maintenance (O&M):	$ 200,000
Total Costs w/ 1 Year O&M:	$ 6,691,669

Additional Notes on Capping Options

Alternatives 4 and 5 (multi-media caps) reduce surface water infiltration by 99 percent, while Alternatives 2 and 3 (clay caps) reduce infiltration by 95 percent.

The cost estimates for alternatives 2, 3, 4, and 5 do not include removal of drummed wastes which may be encountered during excavation. Drum removal will add on roughly $1,000 per container to the overall cost of each of these options.

Groundwater

Site Wide Alternative 6 - NO ACTION.

Under this alternative, no further remedial measures would be taken to remediate the groundwater. Current groundwater contamination would not be addressed, the contaminants would potentially migrate off-site, and pose an endangerment to public health and the environment.

Implementation Time:	None.
Capital Cost:	$ 0
Annual Operation and Maintenance (O&M):	$ 0
Total Costs w/ 1 Year O&M:	$ 0

Site Wide Alternative 7 - Treatment

This groundwater treatment alternative includes:

* extraction of groundwater to capture and halt the flow of the plumes.
* removal of heavy metal contaminants by chemical precipitation followed by pH adjustment (if necessary).
* removal of several organic contaminants, including ketones, by a biological treatment system.
* removal of residual organic contaminants via air stripping.
* further removal of residual organic contaminants via granular activated carbon (GAC) (or other carbon adsorption methodology, if necessary).
* discharge of treated water to the groundwater via a seepage basin situated over the IW and PDSLD soils areas of concern.
* groundwater monitoring through a system of wells to assess the effectiveness of the system at:
    * halting the migration of contamination.
    * reducing the levels of contamination in the soils and groundwater, over time.
* a process effluent sampling program to aid in determining the effectiveness of the remedy.
* fencing and deed restrictions, as necessary, to ensure the integrity of the remedy.
* Residential well sampling will be continued, in conjunction with that called for in the final remedial actions at the neighboring Spiegelberg Superfund Site.

The final processes to be installed for groundwater cleanup will be determined by treatability studies during design.

Since contamination has been confirmed in the location of groundwater monitoring well RA-MW-27, groundwater will need to be purged from this location and will need to be manifolded into the treatment system feed supply line for treatment prior to discharge.

Implementation Time:	Minimum of 5 years.
Capital Cost:	$ 2,740,000
Annual Operation and Maintenance (O&M):	$ 4,580,000
Total Costs w/ 1 Year O&M:	$ 7,320,000

This groundwater treatment alternative would initially cost roughly $150,000 less if injection wells were used rather than a seepage basin for re-introduction of treated groundwater.

The reinjected water from the treatment system will not contain contaminant levels in excess of the levels specified in Table 1, and the system will be designed as a "closed loop" so that contaminated groundwater will not migrate off-site. The ultimate goal of this treatment option is to reduce groundwater contaminant levels to that which are protective of public health and the environment, based on the potential for groundwater use at the site. The goal of flushing for the PDSLD/IW soils is to reduce contaminant levels to that which will not continue to adversely impact the groundwater resource. This is discussed further on in the sections entitled "Attainment of Goals" and "Compliance Points".

Treatment system sludges generated on site will be tested to verify their characteristic nature and properties in order to determine if they are subject to the RCRA Subtitle C requirements, including the Land Disposal Restrictions (LDRs), or other pertinent regulations. Those sludges which are not subject to the RCRA requirements will be disposed of on-site, or at a landfill meeting applicable Federal and State regulations. Those sludges identified as RCRA hazardous wastes, will be processed to ensure compliance with LDR treatment standards, prior to disposal at a RCRA licensed landfill. The activated carbon will be regenerated off site at a permitted facility. A monitoring system designed to verify capture of the contaminant plume will be implemented, and will include monitoring of residential wells in the area.

Summary of Comparative Analysis of the Remedial Alternatives

The following nine criteria, outlined in the NCP at Section 300.430(e)(9)(iii), were used to compare the alternatives and to determine the most appropriate alternative for remediation of the soils and groundwater that is protective of human health and the environment, attains applicable or relevant and appropriate requirements (ARARs), is cost-effective and represents the best balance among the evaluating criteria. The paragraph(s) following each criterion detail how the alternatives meet or fail to meet, that criterion. This comparison of alternatives considers the "action" options for soils and for groundwater as complete site-wide alternatives, particularly as they pertain to Alternatives 2 and 4. For these two alternatives, the soils action is interdependent with the groundwater seepage basin alternative. For Alternatives 3 and 5, which include excavation and consolidation of waste areas, the groundwater Alternative 7 would include the less-costly reinjection well process option.

1. Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced or controlled through treatment, engineering controls or institutional controls.

All of the site-wide alternatives considered for the soils areas, with the exception of the No Action Alternative, provide adequate protection by reducing risk to human health and the environment by capping soils available for dermal contact, and by limiting the potential for further contaminant migration, via infiltration, to the groundwater. Alternatives 4 and 5, multi-media caps, offer greater reduction of surface water infiltration than do Alternatives 2 and 3, the clay caps. Short term risks associated with Alternatives 2, 3, 4 and 5 are primarily due to dust from construction activities. A health and safety program which includes worker protection and dust suppression will reduce these risks.

Alternatives 3 and 5 include further excavation of the PDSLD soils and consolidate these soils within the site unit. The combination of the non-excavation soils alternatives (2 and 4) and a groundwater remedy with seepage basins remove contaminants with minimal disturbance, as compared to the excavation options.

Although Alternative 4 with Alternative 7 achieves the greatest overall level of protection of the alternatives being considered, Alternative 2 with Alternative 7 is also adequately protective. Implementation of either of these remedies would greatly reduce the present and potential future exposure risks by: removing contaminated source material through the groundwater purge system; decreasing surface water infiltration in the capped areas (inhibiting contaminant mobility); and limiting potential dermal and inhalation exposures to contaminated surface soils.

The soils No Action Alternative 1 does nothing to prevent further contamination of groundwater, or prevent dermal contact exposure from residual contamination. The No Action Alternative 6 would not provide protection from existing and potential future risks to the groundwater.

2. Compliance with ARARs addresses how the proposed alternative complies with all applicable or relevant and appropriate requirements of Federal and more stringent State environmental laws (ARARs) and also considers how alternatives comply with advisories or other guidance that do not have the status of laws, but that the U.S. EPA and the State have agreed should be considered for

protectiveness, or to carry out certain actions or requirements.

A summary of identified ARARs for the soils and groundwater alternatives are presented in Tables 2 and 3, respectively. All potential ARARs are included in the Tables, which indicates which ARARs are now Applicable or Relevant and Appropriate. The key following the tables indicates whether the ARAR is chemical-specific (C), location-specific (L), and/or action-specific (A). As discussed in detail further on in this ROD, the selected combination of remedies will attain all pertinent ARARs. These tables list only those identified ARARs necessary for onsite remedial activities. In some instances, the rules cited contain both substantive and procedural or administrative requirements. Only the substantive requirements are ARARs for the purpose of on-site activities. Examples of administrative or procedural requirements which are not considered ARARs include, but are not limited to, reporting requirements and permit application requirements.

The No Action alternative does not comply with all requirements of the identified ARARs for the contaminated groundwater plume. The majority of the remaining potential ARARs identified are not applicable, relevant or appropriate to the groundwater No Action Alternative. Adoption of this alternative would not prevent further migration of contaminated groundwater.

Both the Federal and State Safe Drinking Water Acts are not applicable (the aquifer under the site is not used for a community or non-community public water supply) to the Rasmussen groundwater considerations, but are relevant and appropriate since they regulate Maximum Contaminant Levels in drinking water for protection of human health. The aquifer of concern here is the source of drinking water for the area. Table 11-2 and Chapters 11.1.3 and 11.2.3 in Volume II of the Feasibility Study address ARARs for the Rasmussen groundwater Alternatives. Alternative 7 will attain ARARs specific to individual component actions (i.e., chemical precipitation, biological treatment, air stripping, and carbon adsorption).

Alternatives 2, 3, 4, and 5 for soils will meet Federal and State ARARs, while the No Action Alternative does not comply with any of the identified ARARs for the soils areas. Both the multi-media and Michigan Act 64 clay caps comply with the requirements found in the Resource Conservation Recovery Act at 40 CFR Part 264 <u>et.seq.</u> Please refer to Sections 9.1.3, 9.2.3, 9.3.3, 9.4.3, 9.5.3 of Volume II of the Feasibility Study, and Table 9-2 in Volume III of the Feasibility Study, for discussions of the soils Alternatives and ARARs.

Table 2 - ARARs Summary Site-Wide Alternatives Rasmussen Soils Areas for Alternatives 1,2, and 3			
	ALTERNATIVE 1 NO ACTION ALTERNATIVE	ALTERNATIVE 2 CLAY CAP	ALTERNATIVE 3 EXCAVATION/CLAY CAP
FEDERAL ARARs			
RESOURCE CONSERVATION AND RECOVERY ACT (A and C)			
RCRA 40 CFR 264 Standards for owners and operators of hazardous waste TSD facilities.	Not an ARAR	40CFR 264.310;40CFR 264.116-117 Requirements are not applicable because RCRA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.	40CFR 264.310;40CFR 264.116-117 Requirements are not applicable because RCRA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.
CLEAN AIR ACT (A)			
CAA 40 CFR 50 These regulations establish the National Primary and Secondary Ambient Air Quality Standards for sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.	40 CFR 50.1-50.12 This requirement is applicable since air contaminants may be emitted.	40 CFR 50.6 Requirement is applicable since construction operations would be subject to the TSP standard (150 ug/m^3 - 24 hour average).	40 CFR 50.6 Requirement is applicable since excavation and construction operations would be subject to the TSP standard (150 ug/m^3 - 24 hour average).
OCCUPATIONAL SAFETY AND HEALTH ACT (A)			
OSHA 29 CFR 1910 Occupational safety and health standards adopted to provide safe or healthful employment.	Not an ARAR	29 CFR 1910.120 Requirement is applicable since cap construction operations would take place at a hazardous waste site designated for cleanup.	29 CFR 1910.120 Requirement is applicable since excavation and construction operations would take place at a hazardous waste site designated for cleanup.

Table 2 - Page 2

	ALTERNATIVE 1 NO ACTION ALTERNATIVE	ALTERNATIVE 2 CLAY CAP	ALTERNATIVE 3 EXCAVATION/CLAY CAP
OCCUPATIONAL SAFETY AND HEALTH ACT (A)			
OSHA 29 CFR 1926 Regulations set forth the safety and health standards for construction and related activities.	Not an ARAR	29 CFR 1926 Requirement is applicable for all on-site construction related activities.	29 CFR 1926 Requirement is applicable for all on-site construction related activities.
STATE ARARs			
HAZARDOUS WASTE MANAGEMENT ACT (A)			
HWMA - ACT 64 Regulations containing standards for generators and transporters of hazardous waste and owners and operators of TSDFs.	Not an ARAR	MAC R299.9619(5);R299.9620(2); R299.9611-9612 Requirements are not applicable because HWMA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.	MAC R299.9619(5);R299.9620(2); R299.9611-9612 Requirements are not applicable because HWMA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.
AIR POLLUTION ACT (A)			
APA - ACT 348 Rules containing emissions limitations and prohibitions for particulate matter, fugitive dust, and VOCs.	MAC R336.1901 Requirement is applicable since air contaminants may be emitted.	MAC R336.1371-R336.1373 Requirements are applicable since construction operation at the site are potential sources of fugitive dust.	MAC R336.1371-R336.1373,R336.1901 R336.1301;R336.1331;R336.1702 These requirements are applicable since excavation and construction operations at the site are potential sources of fugitive dust. Excavation operation would be subject to State standards for emissions of VOCs and particulate matter.

Table 2 - Page 3

	ALTERNATIVE 1 NO ACTION ALTERNATIVE	ALTERNATIVE 2 CLAY CAP	ALTERNATIVE 3 EXCAVATION/CLAY CAP
SOIL EROSION SEDIMENTATION CONTROL ACT (A)			
SESCA - ACT 347 Regulations prescribing the requirements for soil erosion and sedimentation control measures and procedures.	Not an ARAR	MAC R323.1701-R323.1714 Requirements are applicable since construction operations would involve earth changes and the potential for soil erosion.	MAC R323.1701-R323.1714 Requirements are applicable since excavation and construction operations would involve earth changes and the potential for soil erosion.
FROST LAWS (A AND L)			
MCLA - 257.722 Rules governing the reduction of maximum axle loads during the period of March - May.	Not an ARAR	Section 257.722 Requirement is applicable since materials could be transported to the site from March to May.	Section 257.722 Requirement is applicable since materials could be transported to the site from March to May.
MINERAL WELL ACT (A)			
MINERAL WELL ACT 315 Rules describing the permitting requirements for drilling brine, storage, disposal, and test wells.	Not an ARAR	MAC R299.2211-R299.2229 Requirements are applicable since monitoring wells will be installed up and downgradient of the capped area, as part of the groundwater monitoring requirements (R299.9612).	MAC R299.2211-R299.2229 Requirements are applicable since monitoring wells will be installed up and downgradient of the capped area, as part of the groundwater monitoring requirements (R299.9612).
ENDANGERED SPECIES ACT (L)			
ENDANGERED SPECIES ACT Rules contain a listing of the fish, wildlife, and plant species that have been determined to to be endangered or threatened.	Not an ARAR	MAC R299.1021-R299.1028 These requirements are applicable since one threatened species, the Eastern Sand Darter (*Ammocrypta pellucida*), and one special concern species, the Dwarf Hackberry (*Celtis tennifolia*), have been reported to occur on or near the site.	MAC R299.1021-R299.1028 These requirements are applicable since one threatened species, the Eastern Sand Darter (*Ammocrypta pellucida*), and one special concern species, the Dwarf Hackberry (*Celtis tennifolia*), have been reported to occur on or near the site.

Table 2 - Page 4

	ALTERNATIVE 1 NO ACTION ALTERNATIVE	ALTERNATIVE 2 CLAY CAP	ALTERNATIVE 3 EXCAVATION/CLAY CAP
MICHIGAN WATER RESOURCES COMMISSION ACT (A AND C) ***			
MWRCA - ACT 245 Statute and rules protect groundwater resources from injurious substances and provide for the non-degradation of groundwater.	Section 323.6(1) Requirement is applicable since injurious substances from hazardous waste leachate would continue to migrate toward groundwater.	Section 323.6(1) MAC R323.2201 et. seq. Requirement is applicable because hazardous substances exist in the soils which may discharge to the groundwater. Remedy prevents such discharge.	Section 323.6(1) MAC R323.2201 et. seq. Requirement is applicable because hazardous substances exist in the soils which may discharge to the groundwater. Remedy prevents such discharge.
ENVIRONMENTAL RESPONSE ACT RULES (A AND C)			
ENVIRONMENTAL RESPONSE ACT RULES Rules describe cleanup criteria for response activities.	MAC R299.5601-R299.5727 Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.	MAC R299.5601 Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.	MAC R299.5601 R299.5727 Part 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.

***The State has identified Michigan Act 245, Part 22 Rules as an applicable ARAR. The United States disagrees that Act 245, as interpreted and applied by the State in this matter, is an ARAR. This issue is the subject of litigation in U.S. v. Akzo Coatings of America, appellate case numbers 89-2902 and 89-2137.

Table 2 - Page 5

	ALTERNATIVE 4 MULTI-MEDIA CAP	ALTERNATIVE 5 EXCAVATION/MULTI-MEDIA CAP
	FEDERAL ARARs	
	RESOURCE CONSERVATION AND RECOVERY ACT (A and C)	
RCRA 40 CFR 264 Standards for owners and operators of hazardous waste TSD facilities	40 CFR 264.310;40 CFR 264.116-117 Requirements are no applicable because RCRA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate situations and circumstances.	40 CFR 264.310;40 CFR 264.116-117 Requirements are not applicable because RCRA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.
	CLEAN AIR ACT (A)	
CAA 40 CFR 50 These regulations establish the National Primary and Secondary Ambient Air Quality Standards for sulfur dioxide, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.	40 CFR 50.6 Requirement is applicable since construction operations would be subject to the TSP standard (150 ug/m^3 - 24 hour average).	40 CFR 50.6 Requirement is applicable since excavation and construction operations would be subject to the TSP standard (150 ug/m^3 - 24 hour average).
	OCCUPATIONAL SAFETY AND HEALTH ACT (A)	
OSHA 29 CFR 1910 Occupational safety and health standards adopted to provide safe or healthful employment	29 CFR 1910.120 Requirement is applicable since cap construction operation would take place at a hazardous waste site designated for cleanup.	29 CFR 1910.120 Requirement is applicable since excavation and construction operations would take place at a hazardous waste site designated for cleanup.
OSHA 29 CFR 1926 These regulations set forth the safety and health standards for construction and related activities.	29 CFR 1926 Requirement is applicable for all on-site construction related activities.	29 CFR 1926 Requirement is applicable for all on-site construction related activities.

Table 2 - Page 6

	ALTERNATIVE 4 MULTI-MEDIA CAP	ALTERNATIVE 5 EXCAVATION/MULTI-MEDIA CAP
	STATE ARARs	
	HAZARDOUS WASTE MANAGEMENT ACT ACT (A)	
HWMA - ACT 64 Regulations containing standards for generators and transporters of hazardous waste, and owners and operators of hazardous waste TSDFs.	MAC R299.9619(5);R299.9620(2); Requirements are not applicable because HWMA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.	MAC R299.9619(5);R299.9620(2);R299.9611-9612 Requirements are not applicable because HWMA hazardous waste was placed at the site prior to the effective dates. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to the site.
	AIR POLLUTION ACT (A)	
APA - ACT 348 Rules containing emissions limitations and prohibitions for particulate matter, fugitive dust, and VOCs.	MAC R336.1371-R336.1373 Requirements are applicable since construction operations at the site are potential sources of fugitive dust.	MAC R336.1371-R336.1373;R336.1901; R336.1301;R336.1331;R336.1702 Requirements are applicable since excavation and construction operations at the site are potential sources of fugitive dust. Excavation operations would be subject to State standards for emissions of VOCs and particulate matter.
	SOIL EROSION SEDIMENTATION CONTROL ACT (A)	
SESCA - ACT 347 Regulations prescribing the requirements for soil erosion and sedimentation control measures and procedures.	MAC R323.1701-R323.1714 Requirements are applicable since construction operations would involve earth changes and the potential for soil erosion.	MAC R323.1701-R323.1714 Requirements are applicable since excavation and construction operations would involve earth changes and the potential for soil erosion.
	FROST LAWS (A AND L)	
MCLA - 257.722 Rules governing the reduction of maximum axle loads during the period of March - May.	Section 257.722 Requirement is applicable since materials could be transported to the site from March to May.	Section 257.722 Requirement is applicable since materials could be transported to the site from March to May.

Table 2 - Page 7

	ALTERNATIVE 4 MULTI-MEDIA CAP	ALTERNATIVE 5 EXCAVATION/MULTI-MEDIA CAP
	MINERAL WELL ACT (A)	
MINERAL WELL ACT 315 Rules describing the permitting requirements for drilling brine, storage, disposal, and test wells.	MAC R299.2211-R299.2229 Requirements are applicable since monitoring wells will be installed up and downgradient of the capped area, as part of groundwater monitoring requirements (R299.9612).	MAC R299.2211-R299.2229 These requirements are applicable since monitoring wells will be installed up and downgradient of the capped area, as part of the groundwater monitoring requirements (R299.9612)
	ENDANGERED SPECIES ACT (L)	
ENDANGERED SPECIES ACT Rules contain a listing of the fish, wildlife, and plant species that have been determined to be endangered or threatened.	Mac R299.1021-R299.1028 Requirements are applicable since one threatened species, the Dwarf Hackberry (<u>Ammocrypta pellucida</u>),and one special concern species, the Dwarf Hackberry (<u>Celtis tennifolia</u>), have been reported to occur on or near the site.	MAC R299.1021-R299.1028 Requirement are applicable since one threatened species, the Eastern Sand Darter (<u>Ammocrypta pellucida</u>), and one special concern species, the Dwarf Hackberry (<u>Celtis tennifolia</u>), have been reported to occur on or near the site.
	MICHIGAN WATER RESOURCES COMMISSION ACT (A AND C) ***	
MWRCA - ACT 245 Statute and rules protect groundwater resources from injurious substances and provide for the non-degradation of groundwater.	Section323.6(1) MAC R323.2201<u>et.seq</u>. Requirement is applicable because hazardous substances exist in the soils which may discharge to the groundwater. Remedy prevents such discharge.	Section 323.6(1) MAC R323.2201 <u>et.seq</u>. Requirement is applicable because hazardous substances exist in the soils which may discharge to the groundwater. Remedy prevents such discharge.

***The State has identified Michigan Act 245, Part 22 Rules as an applicable ARAR. The United States disagrees that Act 245, as interpreted and applied by the State in this matter, is an ARAR. This issue is the subject of litigation in <u>U.S. v. Akzo Coatings of America</u>, appellate case numbers 89-2902 and 89-2137.

	ALTERNATIVE 4 MULTI-MEDIA CAP	ALTERNATIVE 5 EXCAVATION/MULTI-MEDIA CAP
	ENVIRONMENTAL RESPONSE ACT RULES (A AND C)	
ENVIRONMENTAL RESPONSE ACT RULES Rules describe cleanup criteria for response activities.	MAC R299.5601-R299.5727 Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.	MAC R299.5601-R299.5727 Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.

Table 3 - ARARs Summary for No Action and Treatment Alternative for the Rasmussen Groundwater Plume		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
FEDERAL ARARs		
RESOURCE CONSERVATION AND RECOVERY ACT (A and C)		
RCRA 40 CFR 268 Land disposal restrictions.	Not An ARAR	40 CFR 268 Subtitle C Requirement is applicable since chemical sludges will need to be TCLP tested for proper disposal.
RCRA 40 CFR 264 Standards for owners and operators of hazardous waste treatment storage and disposal facilities.	Not an ARAR	40 CFR 264.94; 264.100 These requirements are not applicable since groundwater is not contaminated with RCRA hazardous waste. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to those at the site.
		40 CFR 264.301; 264.303-304; 264.310; 40 CFR 264.91-100; 264.111; 264.116-117 RCRA hazardous waste (chemical precipitation sludge) would be placed in a landfill, and covered with a cap. Therefore, these requirements are applicable.
		40 CFR 264.271; 264.273; 264.278 These requirements are not applicable since non-RCRA hazardous wastes (bio treatment sludge) would be land treated. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to those at the site.
RCRA 40 CFR 263 Standards applicable to transporters of hazardous waste.	Not an ARAR	40 CFR 263 Transfer requirements are applicable for all off-site shipments of hazardous waste (chemical precipitation sludge).
RCRA 40 CFR 262 Standard applicable to generators of hazardous waste.	Not an ARAR	40 CFR 262 Hazardous waste generator requirements would be applicable for all hazardous wastes transported off-site (chemical Precipitation (sludge).

Table 3 - Page Two		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
SAFE DRINKING WATER ACT (C)		
SDWA 40 CFR 141 Regulations to protect human health from drinking water contaminants. Establishes MCLs and MCLGs.	40 CFR Part 141 Requirement is not applicable since the aquifer under the site is not used to supply a community or non-community water system. Requirement is relevant and appropriate since it regulates circumstances sufficiently similar to those at the site.	40 CFR Part 141 Requirement is not applicable since the aquifer under the site is not used to supply a community or non-community water system. Requirement is relevant and appropriate since it regulates circumstances sufficiently similar to those at the site.
CLEAN AIR ACT (A)		
CAA 40 CFR 50 Requirements establish the National Primary and Secondary Ambient Air Quality Standards for among other things, particulate matter	Not an ARAR	40 CFR 50.1-50.12 Requirements are applicable since emissions from the treatment system would be subject to Primary and Secondary Ambient Air Quality Standards. Construction activities would be subject to the TSP standard.
OCCUPATIONAL SAFETY AND HEALTH (A)		
OSHA 29 CFR 1910 Occupational safety and health standards adopted to provide safe or healthful employment.	Not an ARAR	29 CFR 1910.120 Requirement is applicable since construction operations would take place at a hazardous waste site designated for cleanup.
OCCUPATIONAL SAFETY AND HEALTH (A)		
OSHA 29 CFR 1926 Regulations set forth the safety and health standards for construction activities.	Not an ARAR	29 CFR 1926 Requirement is applicable for all on-site construction related activities.

Table 3 - Page Three		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
DEPARTMENT OF TRANSPORTATION (A)		
DOT 49 CFR 107 Prescribes the procedures utilized by the Materials Transportation Bureau, OHMP and OOE for transport of hazardous materials.	Not an ARAR	49 CFR 107 Requirement is applicable since hazardous wastes (chemical precipitation sludge) would be transported to an off-site disposal facility.
DOT 49 CFR 171 Contains general information, regulations, and definitions governing the transportation of hazardous materials.	Not an ARAR	49 CFR 171 Requirement is applicable since hazardous wastes (chemical precipitation sludge) would be transported to an off-site disposal facility.

Table 3 - Page Four		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
	STATE ARARs	
	HAZARDOUS WASTE MANAGEMENT ACT (A)	
HWMA - Act 64 Regulations containing standards for generators and transporters of haz. waste, and owners of TSDFs.	Not an ARAR	MAC R299.9612 Requirements are not applicable since groundwater is not contaminated with HWMA waste. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to those at the site.
		MAC R299.9602-9604; R299.9611-9613;R299.9619-9622 Requirements are applicable because HWMA waste (chemical precipitation sludge) would be placed in a capped landfill.
		MAC R299.9301-R299.9311 Hazardous waste generator requirements would be applicable for all wastes transported off-site (chemical precip. sludge).
		MAC R299.9404-R299.9412 Transporter requirements are applicable for all wastes transported off-site (chemical precip. sludge).
		MAC R299.9618 Requirements are not applicable since non-HWMA wastes (bio treatment sludge) would be land treated. Requirements are relevant and appropriate since they regulate circumstances sufficiently similar to those at the site.
	AIR POLLUTION ACT (A)	
APA - ACT 348 Rules containing emissions limitations and prohibitions for particulate matter, fugitive dust, and VOCs.	Not an ARAR	MAC R336.1702;R336.1901; R336.1371-1373 Requirements are applicable since emissions from the treatment system would be subject to State standards for VOCs. Construction activities are potential sources of fugitive dust.

Table 3 - Page Five		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
	SOIL EROSION SEDIMENTATION CONTROL ACT (A)	
SESCA - ACT 347 Regulations prescribing the requirements for soil erosion and sedimentation control measures and procedures.	Not an ARAR	MAC R323.1701-R323.1714 Requirements are applicable since construction would involve earth changes and the potential for soil erosion.
	FROST LAWS (A and L)	
MCLA - 257.722 Rules governing the reduction of maximum axle loads during the period March - May.	Not an ARAR	Section 257.722 Requirement is applicable since wastes (chemical precipitation and bio treatment sludges) could be transported from the site during the period March - May.
	SAFE DRINKING WATER ACT (C)	
SDWA - Act 399 Regulations establishing MCLs for certain contaminants in addition to the Federal MCLs.	MAC R325.10601-R325.10607 Requirements are not applicable since the aquifer underlying the site is not used to supply a community or non-community water system. Requirement is relevant and appropriate since it regulates circumstances sufficiently similar to those at the site.	MAC R325.10601-R325.10607 Requirements are not applicable since the aquifer underlying the site is not used to supply a community or non-community water system. Requirement is relevant and appropriate since it regulates circumstances sufficiently similar to those at at the site.

Table 3 - Page Six		
	NO ACTION ALTERNATIVE	**TREATMENT ALTERNATIVE**
MICHIGAN WATER RESOURCES COMMISSION ACT (A and C) * **		
MWRCA - ACT 245 This statute and rules protect groundwater resources from injurious substances. Rules contain State water quality standards, treatment plant operator requirements, and wastewater reporting requirements. The rules also implement a waste effluent discharge system compatible with NPDES and provide for the non-degradation of groundwater.	Section 323.6(a) Requirement is applicable since injurious substances from hazardous waste leachate would continue to migrate through the groundwater.	Section 323.6(a); MAC R323.2102-R323.2189; R323.2201-R323.2211; R323.1251-R323.1259 Requirements are applicable since injurious substances are migrating through the groundwater a waste treatment system would be constructed and operated on-site, and the effluent discharged into the groundwater.
WATERWORKS AND SEWERAGE SYSTEM ACT (A)		
WSSA - ACT 98 Rules for classification of sewage or waste treatment plant operators. Rules also contain procedures for construction and operation and maintenance of treatment plants.	Not an ARAR	R299.2901-R299.2927 Requirements are applicable since a waste treatment facility would be constructed and operated on-site.
MINERAL WELL ACT (A)		
MINERAL WELL ACT ACT 315 Rules describing the permitting requirements for drilling brine, storage, disposal, and test wells.	Not an ARAR	MAC R299.2211-R299.2229 Requirements are applicable since extraction, injection and monitoring wells would be installed on site.

***The State has identified Michigan Act 245, Part 22 Rules as an applicable ARAR. The United States disagrees that Act 245, as interpreted and applied by the State in this matter, is an ARAR. This issue is the subject of litigation in [illegible] States of America, appellate case numbers 89-2902 and 89-2137

Table 3 - Page 7

	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
NATURAL RIVERS ACT (L)		
NATURAL RIVERS ACT Promotes public health and prevents ecological damage due to the unwise development within the natural river district.	Not an ARAR	Not an ARAR
INLAND LAKES AND STREAMS ACT 346 Regulates all activities below the high water mark on inland lakes and streams.	Not an ARAR	Not an ARAR
WETLANDS PROTECTION ACT 203 Provides for the preservation, management, protection and use of wetlands by prohibiting certain activities requiring permits and imposing penalties for violations of the Act.	Not an ARAR	Not an ARAR
ENDANGERED SPECIES ACT (L)		
ENDANGERED SPECIES ACT 203 Rules contain a listing of the fish, wildlife and plant species that have been determined to be endangered or threatened.	Not an ARAR	MAC R299.1021-R299.1028 Requirements are applicable since one threatened species, the Eastern Sand Darter (Ammocrypta pellucida), and one special concern species, the Dwarf Hackberry (Celtis tennifolia), have been reported to occur on or near the site.

Table 3 - Page 8		
	NO ACTION ALTERNATIVE	TREATMENT ALTERNATIVE
ENVIRONMENTAL RESPONSE ACT RULES (C)		
ENVIRONMENTAL RESPONSE ACT RULES Rules describe cleanup criteria for response activities.	MAC R299.5601 R299.5727 Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.	MAC R299.5601 R299.5727 Parts 6 and Parts 6 and 7 of the Act 307 Rules provide that remedial actions be protective of public health, safety, and welfare and the environment and natural resources, and the attainment of cleanup standards under Type A, B, or C cleanup. Parts 6 and 7 are ARARs for the remedial action.

<u>KEY TO TABLE 5 SYMBOLS</u>

A = Denotes an Action Specific ARAR

C = Denotes a Chemical Specific ARAR

L = Denotes a Location Specific ARAR

The groundwater cleanup standards and soil cleanup compliance points chosen for this site (for all Action Alternatives) are based on Section 121 of CERCLA and the NCP. The substantive provisions of Michigan Act 307 Rules, Parts 6 and 7, are ARARs consistent with the provisions under CERCLA Section 121(d)(2)(A)(ii), for the remedial action to be undertaken at the Rasmussen site. The Act 307 Rules provide that remedial actions shall be protective of public health, safety, welfare, the environment and natural resources (R299.5601(1)). Criteria for Types A, B, and C cleanups within the Act 307 Rules provide for the derivation of cleanup standards and compliance points which meet the protectiveness goals stated above. The U.S. EPA and the State agree on the remedy and cleanup standards, since the groundwater is currently used as a drinking water source, and is contaminated, and the soils areas pose a continued current and potential threat to the groundwater resource, if left unremediated.

More detail with regard to compliance with ARARs is provided in this ROD under "Statutory Determinations".

3. Long-term Effectiveness and Permanence refers to the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

Neither of the No Action Alternatives for the soils or the groundwater would be effective long-term solutions to the problems at the site, as they do not address existing or future site risks. The groundwater treatment alternative would provide the greatest reduction in the potential for exposure to groundwater contaminants. This alternative is expected to reduce contaminant concentrations to the cleanup levels. Estimates indicate that long-term protection would be achieved in 5 to 15 years, as the treatment system would reduce the concentration of contaminants over time.

Reintroduction of treated groundwater through the PDSLD/IW areas of concern, by use of seepage basins, will flush the contaminants in the PDSLD/IW soils into the groundwater plume, with subsequent removal by ground water extraction and treatment system. This closed-loop treatment system will provide the best long-term protection of the alternatives considered.

Long term effectiveness would be slightly greater with the multi-media cap than with the clay cap. Long-term management requirements and the consequences of cap failure would be similar for each of the four soils action alternatives. A multi-media cap may require a more-involved maintenance program than the clay cap and, therefore, presents greater uncertainty with regard to cap failure.

4. Reduction of Toxicity, Mobility or Volume Through Treatment refers to the ability of a remedy to meet the preference stated in Section 121(b) of CERCLA, for remedies that involve treatment to reduce permanently the toxicity, mobility, or volume of hazardous substances and contaminants.

The groundwater treatment alternative would nearly eliminate the toxicity, mobility, and volume of contaminants in the site's groundwater because of contaminant removal and destruction. Heavy metal contaminants are precipitated from the process stream, dewatered, stabilized, and disposed of off-site at a permitted facility. The biological treatment process will remove most of the volatile and semivolatile organic contaminants, including ketones, which are less readily removed by air stripping and carbon adsorption. The remaining organic contaminants removed by carbon adsorption, and are destroyed during the off-site reactivation of the carbon.

Contaminants washed through the soil by the seepage basins in Alternative 7 would ultimately be reduced in toxicity, mobility, and volume through treatment by removal in the extraction and treatment system.

The No Action groundwater Alternative does not reduce toxicity, mobility, or volume except for the removal of contamination by natural biological processes over time.

None of the site-wide soils alternatives contributes to the reduction in toxicity, mobility, or volume of contaminants as no treatment is utilized in these alternatives.

5. Short-term Effectiveness addresses the ability of alternatives to manage risks during the construction and implementation phases, and reduce immediate risks posed by the hazardous materials present.

During the design and construction of the selected alternative, the short-term risks potentially posed to the community and workers can be effectively eliminated through proper engineering measures and protective equipment for workers. Alternatives 2 through 5 present similar short-term risks to workers and community. The alternatives including further excavation pose slightly higher risks from dust exposure during the excavation activities. Remedial action objectives would be met after construction of the Act 64 cap. Alternative 7 should effectively address the short-term risks posed to the community and workers by contaminated groundwater. Remedial action objectives would begin to be met after start-up of the treatment system. Ongoing monitoring of private wells in the community will be continued as needed until groundwater cleanup is complete. This criteria does not apply to the No Action Alternative.

6. Implementability is the technical and administrative feasibility of a remedy, including the availability of goods and services needed to implement the chosen solution.

Technical feasibility: The individual technologies used in each of the action alternatives are conventional and well documented. Unusual features are not anticipated to be required for any of the alternatives but will be resolved during the design phase, if encountered. Potential future actions such as removal of contaminated source materials or on-site treatment would be possible under any of the alternatives. There are no differences in the alternatives' ability to be monitored for effectiveness.

Administrative feasibility: Alternatives 2 through 5 and Alternative 7 are more administratively feasible than the No Action Alternatives 1 and 6, since they address the final remedial action objectives of the site (to varying degrees). Alternatives 2 through 5 require similar coordination between Agencies and other potentially affected interests. The No Action Alternative would require substantial ongoing review effort by State and Federal Agencies.

Availability of services and materials: The technologies used under each of the soils action alternatives are conventional and similar. Alternative 7 does not require any obscure services.

7. Cost includes capital and operation and maintenance costs.

The costs of individual alternatives are detailed above. The No Action Alternatives have no direct costs associated with them. The alternatives with excavation are more costly than those without. Likewise, multi-media caps are more expensive than the single-media clay caps.

Since the groundwater purge and treat system is being considered as an integral part of the treatment for a portion of the contaminated soils areas, and for the treatment of existing contaminated groundwater, savings are incurred by use of this procedure. As stated previously, Alternative 7 costs roughly $150,000 more with the use of a seepage basin rather than reinjection wells. Alternative 4, without excavation, costs roughly $144,500 less than Alternative 5, with excavation. The multi-media cap costs $2 million more than the clay cap, and cannot be economically justified based on the marginal improvement in reducing water infiltration. The remedy afforded by the combination of Alternatives 7 and 2 can be implemented at little additional cost, while achieving removal and partial destruction of soil contamination in the PDSLD/IW area.

<u>all parameters at both on- and off-site locations is unwarranted due to cost and consideration of site hydrogeology, according to the RSSC.</u>

Groundwater monitoring of site closure under Act 64 requires compliance with 40 CFR Part 264 subpart F. This subpart requires a groundwater system that consists of a sufficient number of wells representing background water quality and allows for detection of contamination when hazardous wastes or constituents have migrated from the waste management area. It is implied, therefore, that the detection system be constructed so that potential migration in any direction be intercepted.

<u>Monitoring of off-site residential wells would be duplicative and is unnecessary, according to RSSC.</u>

The Livingston County Health Department has the responsibility for ensuring that residential water supplies are safe to consume. A major concern of the LCHD was that a safe water supply be provided to the area. They suggested that alternate public water be provided to the area around the two Superfund sites, as municipal supplies are generally monitored more closely (frequently) than residential supplies. The feasibility of this was evaluated along with other alternatives. It was determined that regular monitoring of the existing residential supplies, until remediation could be assured, was the preferred alternative. Toward that end, MDNR is currently arranging for the sampling of residential wells to be conducted contractually. Any agreement for remediation will also include the perpetuation of this monitoring until groundwater cleanup at the site has been achieved.

Residential well sampling will be continued, in conjunction with that called for in the final remedial actions at the neighboring Spiegelberg Superfund Site.

The final processes to be installed for groundwater cleanup will be determined by treatability studies during the design.

Since contamination has been confirmed in the location of groundwater monitoring well RA-MW-27, groundwater will need to be purged from this location and will need to be manifolded into the treatment system feed supply line for treatment prior to discharge.

The preferred site-wide alternative for the Rasmussen soils areas of concern is Alternative 2, which includes:

* A Michigan Act 64 clay cap constructed over all wastes in the TML and NEBD areas of concern as they now exist spatially on-site. This includes:
    * a one-foot thick vegetated soil layer on top,
    * a drainage layer at least 1 foot thick, and
    * a layer of compacted clay 3 feet thick with a permeability of 1E-07 cm/sec or less.
* A groundwater monitoring program established at appropriate locations, depths, and frequency, to detect any changes in groundwater quality, which would indicate any failure of the unit.
* Access restrictions, such as fencing, will be placed around the capped soil areas.
* Institutional controls, such as deed restrictions, will be put in place to prevent future intrusive land uses.
* Drums of waste which are currently visible, or which are unearthed during cap implementation, will be disposed of at a licensed RCRA facility.

This portion of the final remedial action will require long-term management to ensure that the integrity of the capping system is not compromised. The access restrictions and fencing will aid in this effort. Long-term management efforts will include periodic well sampling, cap inspection and repair (if necessary), and maintenance of vegetative cover.

Details of the capping construction such as the potential employment of terracing, rip-rapped drainage channels and perimeter runoff collection will be detailed during the design phase of remedial action.

Actual or threatened releases of hazardous substances from this site, if not addressed by the preferred alternative or one of the other active measures considered, may present a current or potential threat to public health, welfare, or the environment.

1. Attainment of Goals

Both MDNR and EPA have determined that the remedy selected provides the best balance among the nine criteria and meets the requirements of CERCLA.

Attainment of the groundwater goals of this remedy is dependant on the meeting of the cleanup levels for groundwater specified in Table 1. When realized, the groundwater remediation will reduce risk to levels consistent with applicable or relevant and appropriate Federal and State requirements, and thus will be protective of human health and the environment.

Completion of the soil flushing portion of this remedy is measured against the reduction of contaminants in the PDSLD/IW soils areas of concern to levels which will not produce leaching of contaminants to groundwater at levels above groundwater cleanup standards (Table 1). Once this cleanup objective has been met, a Type B cleanup level for the PDSLD/IW soils will have been achieved (R299.5711(2)). The compliance point for measuring PDSLD/IW cleanup is described in the next section.

Completion of the capping/monitoring system for the NEBD/TML dump area is the point where the remediation goals for these areas begin to be met. Continued operation and maintenance of the capped areas will ensure the continued attainment of these goals.

2. Compliance Points

Compliance points to be measured during the course of the groundwater remediation, to determine the progress towards and attainment of protective groundwater levels, are: analysis of the treatment system effluent to directly determine the effectiveness of the treatment and to prevent the re-release of inadequately treated chemicals to the environment; and, monitoring well analysis to determine the effectiveness of the treatment system at halting the flow of contaminated groundwater, and to monitor changes in the contaminant concentrations within the plume itself. Residential well monitoring in the direction of groundwater flow will be continued to ensure that these resources remain unaffected. Specifically, the area of attainment to be monitored for the completion of the Rasmussen groundwater contamination remediation extends throughout the plume in the upper aquifer in the area underlying the Rasmussen site. Groundwater cleanup will be measured against those levels listed in Table 1.

The risk posed by the PDSLD/IW areas of concern, as previously noted, is the risk posed by the migration of contamination into the groundwater resource. The objective of the soil flushing portion of the remedy is to eliminate the leaching of contaminants to the groundwater. In order to determine compliance with this objective, the contaminant level in the PDSLD/IW soils must be reduced to less than twenty times the groundwater cleanup level for each chemical, or leach tests performed on the PDSLD/IW soils must produce leachate with contaminant levels below the groundwater cleanup levels (R299.5711(2)), or the results of other test methods (other than TCLP) that accurately simulate conditions at the site must be employed to demonstrate that contaminants are not leaching into the groundwater above the groundwater cleanup levels.

Measurements of cap effectiveness will be conducted through the use of a monitoring well system installed in conjunction with cap construction.

3. Contingencies

Some changes may be made to the remedy as a result of the design studies. However, the cleanup goals must be met by the remedy that is implemented. The following are some of the outstanding issues which will be resolved during negotiations, remedial design, and final remedial action: general system design; site access; maintenance and monitoring; residential well sampling plan; monitoring well placement and sampling frequency; oversight; future Potentially Responsible Party involvement; and determination of background lead and cadmium concentrations.

Statutory Determinations

The selected remedy will control and reduce risks associated with the Chemicals of Concern in the Rasmussen groundwater plume and PDSLD/IW areas of concern. Engineering controls (cap) in conjunction with long-term maintenance and institutional controls will provide adequate protection of human health and the environment from the dump and inclusive areas of concern. The statutory requirements of CERCLA Section 121 will be satisfied to the extent practicable with the implementation of the chosen remedy. The following is an enumeration of how the selected remedy addresses each requirement.

1. Protection of Human Health and the Environment

The selected remedy will provide adequate protection of human health and the environment through the combined use of treatment, engineering and institutional control technologies. Risks associated with contact or consumption of site groundwater will decrease over time because the extraction and treatment system will reduce the concentration of all contaminants to the cleanup levels specified in Table 1. Risk reduction will also be realized upon completion of the flushing and capping portions of the remedy. At completion of this remedy, the carcinogenic risk will be reduced to levels considered protective by the Michigan Act 307 Rules criteria, and well within the EPA's 1E-04 to 1E-06 range. Carcinogenic risk associated with the Rasmussen site's groundwater is currently 7.3E-03. The implementation of the treatment system and the attainment of the required cleanup levels would reduce the carcinogenic risk to 9.2E-05. Non-carcinogenic risk will be reduced to levels acceptable to MDNR and U.S. EPA and consistent with CERCLA. Flushing and extraction will ultimately reduce the PDSLD/IW soil contamination levels to that which will not leach into groundwater at levels above groundwater cleanup standards (R299.5711(2)). The site-specific capping remedy for the remaining soils areas will afford aquifer protection from the effects of residual soil contamination. With proper engineering controls, unacceptable short-term risks will be not be caused by the implementation of this remedy.

2. **Compliance with Applicable or Relevant and Appropriate Requirements**

The remedy selected will meet or attain the applicable or relevant and appropriate Federal and State requirements, and will be implemented in a manner consistent with these laws. Tables 2 and 3 list all of the Applicable or Relevant and Appropriate Requirements (ARARs), and indicate why each is an ARAR for the selection or implementation of the chosen Rasmussen site final remedial action.

In particular, the final remedial action selected for implementation at the Rasmussen site is consistent with the National Contingency Plan and the State's Act 307 Rules. The State has identified Michigan Act 245 Part 22 Rules as an ARAR for the Rasmussen site. The United States disagrees that Michigan Act 245 Part 22 Rules, as interpreted and applied by the State, is an ARAR. This issue is the subject of litigation in U.S. v. Akzo Coatings of America, appellate case numbers 89-2902 and 89-2137. The State agrees with the remedy selected and has indicated that achieving the Act 307 groundwater cleanup requirements in treated groundwater prior to reintroducing it into the aquifer will satisfy the requirements of Act 245.

The groundwater cleanup standards and soil cleanup compliance points chosen for this site are based on U.S. EPA's agreement with the State's recommendation of a combination of all three Types of cleanup for this site. Criteria for complying with the Type A, B, or C cleanups are contained in Michigan's Act 307 Rules. The substantive provisions, Parts 6 and 7 of the Act 307 Rules, are considered ARARs for the remedial action to be undertaken at the Rasmussen site. These Rules provide, inter alia, that remedial actions shall be protective of public health, safety, and welfare and the environment and natural resources (R299.5601(1)). The Act 307 Rules specify that this standard be achieved by a degree of cleanup which conforms to one or more of the Type A, B, or C cleanup criteria. A Type A cleanup generally achieves cleanup to background or non-detectable levels (R299.5707); a Type B meets risk-based cleanup levels in all media (R299.5709, 5711, 5723, and 5725); and Type C cleanup is based on a site-specific risk assessment which considers specified criteria (R299.5717 and 5719). The selected remedy meets this ARAR.

U.S. EPA agrees with the State's recommendation given the fact that the groundwater is currently used as a drinking water source and is contaminated, and that the soils areas pose a continuing current and potential threat to the groundwater resource, if left unremediated.

The emission control requirements of the Clean Air Act (CAA) and the Michigan Air Pollution Control Act are potential ARARs for all alternatives except the No Action Alternative. Construction and treatment system activities are potential sources of fugitive dust, particulates and volatile organic compounds.

The selected remedy may involve the disposal of treatment residuals which are subject to RCRA Land Disposal Restrictions (LDRs). Although RCRA listed wastes have not been found at the site, some RCRA characteristic wastes were removed from the site during the 1989/1990 removal action. Consequently, treatment residuals will be tested to determine if they are RCRA characteristic wastes and subject to the LDRs. If treatment residuals are determined to be hazardous wastes under RCRA, and are transported off-site, the Department of Transportation Rules for the transportation of hazardous materials and RCRA will be applicable to any off-site movement or handling of the hazardous wastes.

Post Section 106 removal observations by EPA's oversight contractor and State staff have indicated that visible drums remain within the areas to be capped. These drums have become visible due to the freeze/thaw weathering cycle which causes slumping of dump and soil materials. The drums removed during the 1989/1990 action were found to contain RCRA characteristic wastes. Due to the fact that wastes removed were RCRA characteristic, and the fact that some drummed materials still remain, the probability exists for RCRA characteristic wastes and residuals to still remain within the TML/NEBD portion of the site. Based on these findings, both RCRA and Michigan Act 64 capping requirements were determined to be relevant and appropriate for closure of these areas.

3. Cost Effectiveness

The comparison of cost effectiveness versus protectiveness achieved is the primary factor for the selection of the combination of preferred alternatives for the Rasmussen site. Public comment for this site centered around the public's expressed preference for complete removal and destruction of all contaminated soils areas including the dump rather than the proposed in-place site-specific remedy. It is also the Agencies statutorily mandated preference for technologies which employ permanent solutions and treatment technologies. The mandate is qualified by the phrase "to the Maximum Extent Practicable." Included in this qualifier is a requirement to balance cost with the effectiveness of a remedy at protecting public health and the environment. Removal and destruction of the dump contents would cost over $100 million. The proposed soils alternatives (including flushing) will cost approximately $10 million. The selected remedy outlined above affords overall effectiveness when measured against the 5 CERCLA Section 121 criteria and the 9 criteria from the National Contingency Plan, and costs are proportionate to the protectiveness which will be achieved.

4. **Utilization of Permanent Solutions and Alternative Treatment (or resource recovery) Technologies to the Maximum Extent Practicable**

The remedy employs the preferred permanent solutions and treatment technologies to the maximum extent practicable. The chosen alternative permanently removes the contaminants from the groundwater resource and flushed soils in the following manner: organic contaminants are extracted via air stripping and carbon adsorption, and are destroyed during the off-site reactivation of the carbon units; the activated sludge process removes and destroys most of the volatile and semi-volatile organic contaminants; and inorganic contaminants are precipitated from the process stream, dewatered, stabilized, and disposed of off-site at a permitted facility. The capping option does not employ permanent solutions or alternative treatment technologies.

5. **Preference for Treatment as a Principal Element**

The principal elements of the selected remedy are the treatment of the contaminated groundwater and flushed soil contaminants, and capping. These elements address the unacceptable risks at the site--the further degradation of groundwater resources, through the combined use of treatment and engineering technologies. Addressing all of the risks through treatment was not found to be cost effective. The chosen remedy, although not wholly a treatment process, is protective of public health and the environment.

Documentation of Significant Changes

The following is a documentation and rationale for significant changes made to the selected remedy since the issuance of the Proposed Plan in August of 1990. None of these changes require the issuance of a revised Proposed Plan or the announcement of a new Public Comment Period, as the remedy does not differ substantively from that which was contemplated in the final stages of the Feasibility Study or the Proposed Plan.

There are two changes in the cleanup levels on Table 1 due to typographical errors in the Proposed Plan. For 1,1-dichloroethene the maximum concentration is 2.0 ppb instead of 590.0 ppb as indicated in the Proposed Plan. This reduces the carcinogenic risk number for 1,1-dichloroethene from 1.0E-02 to 3.4E-05.

Careful re-examination of RI results in response to PRP and public comment has shown levels of trichloroethene on three separate sampling occasions during the RI (240 ppb, 774 ppb, and 120 ppb) in Rasmussen Monitoring Well number 27 (RA-MW-27) (Figure 2). These results were inadvertently overlooked during the risk evaluation since they were recorded as "background" sample locations. Sampling conducted by the PRPs on two subsequent sampling occasions confirmed trichloroethene in RA-MW-27. The PRPs propose to remediate this area by the installation of a separate purge well in this location. The Agencies concur with this proposal, and add that the purged water from the southerly RA-MW-27 extraction well location will be manifolded into the treatment system feed header for treatment prior to discharge. Cleanup levels for groundwater contamination in this area are the same as found in Table 1.

Benzyl alcohol was noted in Table 1 of the Proposed Plan as requiring cleanup. The cleanup level for this chemical, based on Type B criterion was incorrectly calculated and reported as 9.0 ppb. The correct cleanup number based on these criterion is 10.0 ppm (10,000 ppb) based on data from the National Toxicology Program bioassay (1989). The site-derived concentrations of 12.0 ppb do not exceed the corrected cleanup level. Benzyl alcohol has been removed from the list of chemicals of concern for the Rasmussen groundwater plume.

The chemical 2-chlorophenol, has a cleanup level 0.1 ppb based on aesthetics data. However, consideration was not given for detectability. An acceptable method detection limit (MDL) for this chemical is 5.0 ppb. This MDL of 5.0 ppb is the cleanup goal. However, since the aesthetics criterion is significantly less than the MDL, the design should attempt to completely remove 2-chlorophenol from the groundwater.

Since the issuance of the Proposed Plan for the Rasmussen site, new RfD data became available in the IRIS database for 2,4-dimethylphenol. Based on this data, the new groundwater cleanup criterion for 2,4-dimethylphenol is 100 ppb. The maximum concentration detected in Rasmussen groundwater was 27.0 ppb. Therefore 2,4-dimethylphenol is deleted as a chemical of concern for the Rasmussen groundwater remediation.

Reevaluation of the aesthetics data for 2-methylphenol and 4-methylphenol have produced the following respective cleanup levels: 300 ppb and 400 ppb. Since 2-methylphenol was detected at 1,600 ppb, it remains as a chemical of concern with a revised cleanup level of 300 ppb. Since 4-methylphenol was detected on-site at 280 ppb and the cleanup level is set at 400 ppb, this chemical is deleted from the list of groundwater contaminants.

In the Proposed Plan the cleanup level for vinyl chloride was set at 0.18 ppb based on a MDL. The MDNR has recently issued a memorandum which lists MDLs for use with the Act 307 criteria. The memorandum lists the MDL for vinyl chloride at 1.0 ppb, therefore the cleanup number reported in Table 1 has changed to 1.0 ppb. Since the carcinogenic risk level for vinyl chloride is below what can be reliably detected, efforts should be made to detect the substance at levels below 1.0 ppb, and to remediate to those levels, if possible.

Tetrachloroethene was incorrectly reported as a detection of 2.0 ppb on-site. This detection was determined to be unreliable as both on-site and background samples were estimated values of 2.0 ppb. Tetrachloroethene was not reported in any other samplings and is deleted from consideration as a chemical of concern.

Cadmium, as with lead, requires resampling during pre-design studies to confirm its presence as a dissolved contaminant. RI samples were analyzed for total cadmium. The cleanup level in Table 1 has been starred to indicate that the HLSC-based cleanup level of 4.0 ppb may be modified by further analyses.
If studies (and split samplings) show that either 1) on-site filtered cadmium samples are less than 4 ppb, or 2) if on-site filtered cadmium samples are greater than 4 ppb, and on site filtered cadmium samples are less than background filtered cadmium samples, then cadmium may be deleted from the list of chemicals of concern.

RESPONSIVENESS SUMMARY
RASMUSSEN SUPERFUND SITE
GREEN OAK TOWNSHIP, LIVINGSTON COUNTY, MICHIGAN

CONTEXT

This Responsiveness Summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which require the United States Environmental Protection Agency (U.S.EPA) to respond ". . .to each of the significant comments, criticisms, and new data submitted in written or oral presentations. . ." on a Proposed Plan for Remedial Action.

As noted, public participation in Superfund projects is required by SARA. Comments received from the public are considered in the selection of the remedial action for the site. The Responsiveness Summary serves two purposes: to provide the U.S. EPA with information about the community preferences and concerns regarding the remedial alternatives, and to show members of the community how their comments were incorporated into the decision-making process.

SITE OVERVIEW

The Rasmussen site is located on Spicer Road in Green Oak Township, Livingston County Michigan. The adjacent property to the west is another Superfund site known as the Spiegelberg Site. Due to the close proximity, the two sites were investigated as part of one Remedial Investigation, and cleanup alternatives were evaluated through one Feasibility Study Report. However, the sites differ in method of disposal of waste materials. Some waste types overlap between the two sites, as do some of the Potentially Responsible Parties (PRPs). Community relations activities for the two Superfund sites have, for the most part, been combined. Activities for the two sites have become more divergent since approximately 1988, when separate removal and investigative activities were started, and work began to progress at differing rates.

The preferred alternative for the contaminated groundwater and soils at the Rasmussen Site is: the combined use of an extraction/treatment/seepage basin reintroduction system for the treatment of groundwater and flushed soil contaminants, with a capping alternative for the remaining soils areas.

The written and oral comments received from the citizenry and the Livingston County Health Department were in favor of the groundwater remedy chosen. The local citizens expressed a strong desire for the removal of all waste materials, rather than the proposed capping alternative.

In general, comments received from the PRPs supported the proposal for groundwater remediation and capping of the dump wastes. The PRPs' criticisms of the proposed alternatives centered around the application of State ARARs, the selection criteria for chemicals of concern and the calculations of corresponding cleanup levels, the contents of the Administrative Record and the proposed capping design.

BACKGROUND ON COMMUNITY INVOLVEMENT

History

A detailed chronology of community relations activities for the Rasmussen site is attached to this Responsiveness Summary.

Concerns

The Community Relations Plan for the Rasmussen (and Spiegelberg) Superfund Site(s) was completed on October 25, 1984. At that time, key concerns identified were:

* Potential for residential well contamination.
* Lowered property values.
* Potential health hazards.
* Lack of response to citizen concerns.

Other concerns are:

* Off-site airborne releases of contaminants.
* Long-term accountability and maintenance for any in-place remedy chosen.

Effects and Outcomes of Concerns

As a result of the work done on this site over the past five years, some of the key concerns highlighted above were addressed.

* Past sampling rounds have consistently revealed that residential wells are uncontaminated.
* Prices for properties which have recently sold in the area are comparable to prices for similar properties at other locations in the township, according to township officials. The township official did note that since lending companies are aware of the presence of the site, mortgages are difficult to obtain, and the area is not being built up as quickly as it might have in the absence of the site.
* Air monitoring throughout the work zone, and at the site perimeter during the removal actions (peak disturbance), showed that no air releases were measured off-site.
* Adverse health risks have been identified at the site. However, this has not resulted in any reported adverse health effects being experienced by local residents. This will be an ongoing evaluation. During and after the implementation of the remedial action, no adverse health effects from the site are expected.

* The Attachment to this document shows a rich history of community involvement throughout the duration of this project, largely through the efforts of the citizens and the Livingston County Health Department, in organizing citizen's groups and staying involved. The concern expressed most frequently now is that cleanup should proceed more quickly.

SUMMARY OF PUBLIC COMMENTS AND RESPONSES

Comments and questions were received and recorded during a Public Meeting held at the Green Oak Township Hall on September 13, 1990, from 7:40 p.m. to 9:15 p.m. Written comments were also received throughout the Public Comment Period from August 31, 1990 through October 31, 1990. The transcript of the oral comments received at the public meeting and the written comments received during the public comment period are in the Administrative Record for this site. Following is the response to these public comments regarding the Site's Proposed Plan released in August of 1990.

<u>Comments Received at the Public Meeting</u>

The following comments were received and recorded in the transcript of the public meeting. MDNR and U.S. EPA representatives addressed the following questions during the proceedings (see transcript in the Administrative Record). The following answers are presented for further clarification. Comments have been arranged into 7 categories.

1. <u>General Questions and Comments</u>

<u>Is the Rasmussen site a worse problem than the Spiegelberg site?</u>

The Rasmussen site had a wider variety of wastes (mostly drummed) disposed of on site, and these wastes were spread around over a larger area. Based on these factors, the Rasmussen site could be thought of as "worse". The Spiegelberg site, on the other hand, had a large volume of uncontainerized liquid paint waste poured into a soil excavation. From a mobility standpoint, the Spiegelberg paint waste posed a greater problem.

In any event, most of the Rasmussen drummed wastes and all of the Spiegelberg concentrated wastes have been removed. However, the hazardous substances remaining at both sites pose a potential threat to public healtn and the environment, if left unremediated.

2. Past Investigations

Which areas of concern were found to be contributing to groundwater contamination at the Rasmussen site?

The groundwater plume at the Rasmussen site originates from the Probable Drum Storage, Leakage, Disposal Area (PDSLD) and Industrial Waste (IW) areas of concern. To date, no groundwater contamination has been detected as coming from the Northeast Buried Drum Area (NEBD) or Top of Municipal Landfill (TML) dump areas, although the contamination in these areas presents a potential threat to groundwater. Another plume area has been identified as requiring remediation. It is localized in the area of RA-MW-27 where drummed wastes collected after being poured out over the southwest side of the landfill. Please refer to the second question below for a more detailed description of this groundwater contamination.

Are there wells and past samplings in close enough proximity, and screened at the proper depths to detect potential groundwater contamination from the NEBD or TML dump areas?

There are several wells placed closely around these areas of concern which are screened at varying depths, and which would detect groundwater contamination, if present.

The neighboring property owner stated that he observed the dumping of waste over the back side of the hill at the Rasmussen site. He found it hard to believe that there was no groundwater contamination associated with the dump. Other commentors asked follow-up questions as to the testing done around this area.

The Agencies are aware that this dumping occurred, and focused a large amount of effort toward investigating the results of the dumping. Some effects of the dumping were more obvious--over 3,000 drums and a pool of black liquid were removed from the top and south side of the dump in 1984. Careful re-examination of RI results in response to this comment (and based on further PRP sampling), have shown levels of trichloroethene on three separate sampling occasions during the RI (240 ppb, 774 ppb, and 120 ppb) in Rasmussen Monitoring Well number 27 (RA-MW-27) in this exact location (Figure 5-6B in the RI). These results were inadvertently never carried through to the later stages of risk evaluation.

Sampling conducted by the PRPs on two subsequent sampling occasions showed trichloroethene in RA-MW-27. The PRPs propose to clean this area by the installation of a separate purge well in this location. The Agencies concur with this proposal, and add that the purged water from the southerly RA-MW-27 location will need to be manifolded into the influent end of the treatment system for the northerly plume, for combined treatment prior to discharge. Note that more detail is given in the attached ROD under "Documentation of Significant Changes". This topic is also addressed further on with respect to the corresponding PRP comment.

<u>How deep is the deepest well at the Rasmussen site?</u>

Rasmussen Well Number 42 (RA-MW-42) was advanced to a depth of between 190 and 200 feet below grade. It is terminated in a clay layer and monitors the groundwater in the 163 foot to 167 foot interval above the clay. This well was surveyed at approximately 933 feet above mean sea level.

<u>How far south did your testing go?</u>

Surface water sampling went as far south as the peat pond. Soils sampling went to the southern limits of the neighboring Spiegelberg property. Shallow groundwater monitoring also went to the limits of the neighboring property, and business wells to the south were tested as well.

<u>Are there PCBs and dioxins in the PDSLD Area? Are there dioxins in the IW area?</u>

In the most recent continuous core sampling of this area, the maximum level of PCBs detected in surface soils in the PDSLD area was just over 1.0 ppm (A State representative incorrectly stated "one part per billion" at the 9/13/90 public meeting), the current State required cleanup level for PCBs. Past samplings have shown no dioxins in the PDSLD or the IW areas.

<u>One commentor asked to be shown the extent of the Agencies' investigations.</u>

An MDNR representative pointed out several sampling locations based on the Remedial Investigation maps, and provided the commentor with copies of the Remedial Investigation Report.

<u>What were the levels (actual and not average) of dioxins found across the site, and what risks are posed by these levels?</u>

The maximum level found (2.996 ppb TCDD equivalencies) at the site was in a southwesterly soils area on the top of the landfill. Other maximum levels were as follows: Area of Reported Burning (western-central TML) = 0.349 ppb equivalencies; central TML = 0.024 ppb equivalencies; and NEBD = 0.061 ppb equivalencies. TCDD is short for 2,3,7,8-tetrachlorodibenzodioxin, and is considered one of the most toxic forms of dioxin. If different forms of dioxin are found, certain conversion factors are used to express all in terms of TCDD equivalencies.

Toxicological studies (Kimbrough, 1984) state that residential soils at levels above 1 ppb TCDD pose a level of concern. The soils at the Rasmussen TML do not constitute a residential setting, nor do they contain purely the TCDD form of dioxin. The Rasmussen soils containing low-level dioxins do not pose an unacceptable risk to residents living in the vicinity of the Rasmussen site. The presence of dioxin lends support to the decision to cap the TML and NEBD soil areas, but would not have in itself forced this decision.

3. Monitoring of Remedial Actions

Will outside labs be used for testing, to obtain independent verification of monitoring data and to obtain better turn-around times than in the past?

Independent labs will most likely be used when State laboratories are backlogged. If PRPs perform the remedial actions, either the State or Federal oversight personnel will obtain split samples for independent verification.

Citizens requested that the residential wells surrounding the entire site be tested quarterly in perpetuity, for all of the contaminants present at the site. They requested that residential well testing be continued for as long as there is material present at the site. Additionally, citizens requested that all of the sampling data be provided to the households and businesses around the site.

As stated previously, and acknowledged by the commentor, the Agencies' preference is to rely on monitoring of wells in between the contaminated area and residential wells, to detect contaminant migration prior to any impact on drinking water supplies. Plans include monitoring of these intermediate wells on a quarterly basis, once remediation begins, and for as long as waste remains on-site as per CERCLA Section 121(c), 42 U.S.C. Section 9621(c). Some residential well monitoring will be continued as well, with prime focus in the direction of groundwater flow. All monitoring results will be made available to the owners of homes tested, and in general, summaries of all site related monitoring will be provided as part of the periodic updates to the local information repository.

A representative from the Livingston County Health Department asked what plans we had for residential well monitoring in the near future. He requested that LCHD be provided with all data, as the LCHD is a focal point for residential well concerns, and offered assistance if requested.

A State contract is being prepared for residential well monitoring services so that these activities will commence shortly and be continued for as long as is necessary. We will provide all data to the LCHD and gratefully acknowledge their offer of assistance.

Will the soils to be flushed be monitored for effective clean-up?

Monitoring throughout the unsaturated soil zone will be conducted as part of the compliance testing for the PDSLD/IW areas flushing system.

4. Completion of Remedial Actions

When is the groundwater cleanup expected to be complete? When can the public expect to receive a letter saying that the groundwater remediation is complete and safe?

Groundwater cleanup can be expected to take between 5 to 15 years. When remediation goals have been attained, The Agencies will inform the public of this. Residential water supplies currently in existence are safe to drink now. When initiated, the groundwater remediation system will halt the flow of contaminants and remove them from the environment. This will insure continued safety of the groundwater resource.

Can the PDSLD/IW soils be removed, or do dioxin disposal restrictions prohibit this option?

Dioxin disposal restrictions would not prohibit the removal of these two soil areas of concern, as neither contain this chemical. Soil flushing is the preferred alternative for the PDSLD/IW because the soils contamination in this area has been shown to lie just above the groundwater table. Removal would require the excavation of a large amount of relatively uncontaminated soil to get at the soils of concern. These soils might then have to be treated for risk reduction prior to disposal (a costly option, with or without soils treatment). Flushing avoids this unnecessary disturbance (and subsequent backfilling), utilizes the treated water to enhance contaminant uptake, achieves the objective of risk reduction through ultimate treatment, and provides a secondary benefit for water which would otherwise have to be reintroduced to the ground, all for a comparatively small added cost. The third question and answer after this one offers more detail as to this comparison of alternatives.

Citizens expressed their discomfort and displeasure with the Agencies' preference for on-site containment of soil contamination. Reasons expressed were:

- money was being spent to make these materials more permanent in their current location rather than taking them away and doing something with them,
- off-site incineration could be an option for dealing with the dioxin-containing wastes,

- uncertainties exist with regard to the durability of the proposed cap,
- the desire to eventually have a completely clean site, without the need for perpetual maintenance,
- uncertainties with regard to the continuance of PRP Operation and Maintenance (O & M) funding to insure cap integrity,
- uncertainties with regard to the continuance of Agency O & M funding due to changing political climate, and
- cost comparisons should not be the overriding factor for choosing an in-place remedy where potentially, public health is a concern.

In-place remedies (capping) for wastes, are not categorically preferred by the Agencies for site remediation. In selecting the remedy for the Rasmussen dump wastes, the Agencies considered a number of factors including cost, implementability, overall protectiveness, compliance with State and Federal applicable or relevant and appropriate requirements (ARARs), and short- and long-term effectiveness. The two primary considerations in remedy selection are overall protectiveness and compliance with ARARs. Only after these two criteria have been evaluated, are costs (and the other criteria) brought into consideration between remedies which offer equal protectiveness and compliance with ARARs. Such is the case with remedy selection for this site. Evaluation showed that both removal and on-site remedies fared equally with regard to ARARs, and both were found to be protective of public health and the environment. The Agencies feel that when implemented and maintained, an in-place capping remedy will reduce the potential risk to public health and the environment from contaminant migration to groundwater (the potential risk here). Human health, therefore is a concern, and costs only becomes a major distinguishing factor, as it did here, after the determination regarding protectiveness and risk reduction had been made.

Statutory considerations aside, the Agencies can fully appreciate the argument against capping--it seems illogical to make these materials more permanent in this location rather than elsewhere. It is also impractical to take all of the wastes from sites such as this one (primarily municipal garbage), and cap it elsewhere. These remove/not-to-remove considerations are made on a site-by-site basis.

Off site incineration of dioxin-containing soils is not prohibited by statute, but there are problems with locating a facility currently accepting these materials. (The Times Beach, Missouri dioxin site cleanup plan calls for construction of an on-site incinerator to take care of its contaminated soils).

Cap durability is a direct function of correct design and long-term O & M.

Portions of this question pertaining to financial assurances, design, O & M, and cap durability have been addressed under sections 5, 6 and 7 below.

Mr. Tom Haug, the chairperson of the Citizen's Information Committee (CIC) expressed the following: The citizens' preference would be for the complete removal and incineration of all of the Rasmussen soil contamination and the dump. However, he did not express much hope for that to happen, and did want to emphasize that the chosen capping remedy should be monitored, since the proposed plan failed to detail this requirement. Will the monitoring system completely ring the capped area?

The complete removal option was explored in the Feasibility Study and was found not to be cost effective when balanced with the factor of risk reduction. Risks are significantly reduced with the capping alternative and can be monitored to insure the perpetuation of this risk reduction.

The attached Record of Decision itemizes monitoring as a key ingredient to the capping remedy chosen. There are specific requirements in Michigan Act 64 which address the monitoring requirements for capped landfills. The requirements include a system which will monitor the entire capped area. These monitoring requirements will be addressed in the scope of work for the implementation of the chosen remedy.

On Page 13 of the Proposed Plan it states that "excavation and relocation of the remaining PDSLD soils is not a process option, in light of the fact that the majority of the contaminants are located just above the groundwater table." Why is this not an option? It seems odd to introduce more contamination to the groundwater, only to extract it later.

The sentence would have more appropriately read: "Based on investigations as well as technical and cost factors, the remedies which included excavation of soils were eliminated from further consideration." The 1989/1990 soils investigations in the PDSLD area determined that the contamination was largely located near the groundwater table. This soil contamination is located there due to a combination of the leaching of contaminants down through the soil column, volatilization from the groundwater, and wetting of the soils through seasonal water table fluctuations. These mechanisms (particularly the last two) would continue to occur even if soils are excavated and backfilled, causing reintroduction to the soils of any contaminants still in the groundwater. Technically, it will be more effective to leave the PDSLD/IW soils in place and enhance the natural flushing mechanisms. Mechanically, a purge and reintroduction system is already required to address the groundwater contamination, and cost-effectiveness is gained through the secondary benefit of soil flushing.

Admittedly, the concept of moving contaminants toward the groundwater seems counter productive, however, soil flushing has been demonstrated to be an effective remedial technology where relatively homogenous soils are involved over small areas in a closed-loop setting.

<u>The Proposed Plan stated that deed restrictions would be placed on the property to prevent "incompatible" future land uses. What would be considered compatible?</u>

The wording of this statement was perhaps misleading. With wastes capped in place, and in light of the fact that cap integrity must be maintained, there is no use of this property that would be considered compatible.

5. <u>Design and Engineering Concerns</u>

<u>In light of the fact that capping as a remedial alternative has not been field-proven for more than 8 to 10 years, can we estimate how long caps will last with proper O & M?</u>

Caps are expected to last for at least 30 years with the minimally required O & M. With advanced O & M, this estimate can increase proportionally to the amount of re-working done. If areas of the capping and monitoring system are found to be deficient, these can be re-built or reinforced. Once the commitment to implement the remedy is made by either the PRPs or the Agencies and is formalized in the ROD and Consent Decree, the commitment is made to maintain the system, regardless of the magnitude of the potential repairs.

<u>How long will the remediation of the PDSLD/IW areas take, if flushed?</u>

Design studies will have to be conducted to set up the optimum balance between flushing rate (water input rate), soil residence time, and characteristics of the particular contaminants. These studies will take place during the design phase of the remedy. After the studies are completed, the Agencies should have a better idea with regard to the length of time needed for the remediation of the PDSLD/IW areas.

6. Financial Considerations

Why is it not economically feasible to remove the soils to groundwater in the PDSLD and IW? Will it take longer to treat contaminants from both soils and groundwater? The citizens would prefer that these soils be excavated and removed to a secure facility.

The seepage lagoon concept for re-infiltration of treated groundwater is estimated to cost $150,000 more than would a re-infiltration system using injection wells. However, soil disposal costs roughly $200 to $300 per cubic yard for off-site landfilling and approximately $1,400 per cubic yard for incineration. The combined IW and PDSLD areas comprise approximately 9,400 cubic yards of soil. Disposal costs for this volume would range from at least $1,880,000 for off-site landfilling, to $13,160,000 for incineration. These cost estimates do not include on-site equipment costs and personnel.

Through the closed-loop flushing, extraction and treatment, complete removal of contaminants can be obtained over time. For a relatively small added cost, the re-infiltration system can be made to serve "double duty". It is true that the operation of the system will have to be designed to accommodate the additional input from soils and groundwater, but this is not expected to extend the duration of treatment appreciably.

If soils were excavated to groundwater, and the excavation filled with clean soil, these soils would also become contaminated through the seasonal fluctuation of the contaminated groundwater. It is prudent to remediate the soils and groundwater in this area as a unit.

What would it cost to totally remove all of the soil and groundwater contamination, including the landfill?

Estimates generated during the early stages of Feasibility Study preparation show the price for complete removal of all soil areas and landfilled materials between $150,000,000 and $200,000,000. Groundwater contamination removal adds on at least an additional $26,000,000 (capital costs plus 5 times (years) the annual O & M costs as noted in the ROD).

What should a potential developer do now to obtain financing? Will development potential change in the future based on the remedial actions proposed? What liability does a developer have relative to informing home buyers of the sites in the area? Once completed, will the Agencies be issuing a letter stating thatthe cleanup has been completed and assuring the public that there is no need to worry about contamination from the site?

Obviously, lenders and developers have to review and consider their obligation with regard to disclosure to potential clients of the presence of the Rasmussen or other Superfund sites. The Agencies may not advise developers regarding their obligations in this area. Throughout the course of the remediation, the Agencies will be issuing statements of progress. At the completion of the groundwater purging and treatment operation, and likewise, once the cap is in place, the Agencies will notify all persons on the mailing list of the completion of such activities.

The decision to fund any project depends upon the policies of the lending institution. The Agencies cannot offer any short-term solutions or predict the availability of funding for projects in this area. What the Agencies will do is work to implement risk reducing remedial actions using the Superfund process. The status of the cleanup will be reported periodically, to keep all interested parties informed of the progress of the cleanup activities. (Note, there is currently no existing risk from groundwater usage in the vicinity of the Rasmussen site).

<u>Is there going to be a provision for either replacement of the cap at the end of 30 years of maintenance in perpetuity for this cap, and where will the money come from?</u>

If a settlement is reached with the responsible parties to undertake the remedial action, the Agencies' expectation would be that the PRPs would also sign on to undertake the operation and maintenance of the cap for perpetuity. The mechanism for PRP funded O & M varies depending on what is negotiated. Sometimes PRPs sign an agreement to make yearly payments, and sometimes they use the trust fund mechanism.

In the absence of having a settlement with the PRPs, the Federal Superfund would fund the O & M for one year, and the State would pay for O & M from then on.

Maintenance in perpetuity means forever, not just 30 years. See the answer above under Section 5.

<u>What guarantees do we have that if the political climate changes, the cap O & M will continue to be provided by the Agencies? If economic feasibility is the rationale for choosing the cap, then the citizens want to be sure that same reason is not used for taking away the O & M funding.</u>

Although there are no absolute guarantees, the Agencies are under an obligation to continue to protect public health and the environment. The likelihood for discontinued funding for any program exists, but there is a greater likelihood that funding will continue to be provided through one of the various mechanisms.

Economic feasibility was not the only rationale for choosing the cap for this site, rather it was only one of balancing criteria. Please refer to the ROD "Summary of Comparative Analysis of Alternatives" section.

Can EPA comment on the likelihood of actually getting a trust fund set up? Citizens expressed a preference for seeing "the money in the bank" rather than promises to pay.

If O & M is implemented by the Agencies, no trust fund will be set up. It is difficult to speculate on the likelihood of the PRPs setting up a trust fund, however, one of the focuses of the negotiations toward a consent decree will be to obtain financial assurances from the PRPs. EPA's concern is not so much which one of the acceptable mechanisms is proposed, but that adequate assurances are provided. It is up to the PRPs to propose an acceptable mechanism for financial assurances. The State prefers the trust fund mechanism for funding of long-term O & M.

7. Other Verbal Comments

Is October 31, 1990 our last opportunity to have input into what happens at the site? Will we know what comments other persons sent the Agencies in writing? Will we have other information meetings prior to ROD issuance?

Comments and the transcript of the public meeting have been put in the Administrative Record and repositories for review. The public comment period closed on October 31, 1990, after being open for 60 days--thirty more than is required by the National Contingency Plan (NCP). It would not serve the public interest in the expeditious remediation of this site to reopen the public comment period at this time. We will mail out the Responsiveness Summary, which consolidates all comments received during the Public Comment Period, and the Agencies' responses thereto, and ROD, to all persons on the mailing list. The documents will also be in the Administrative Record and repositories for review. After these are issued, we will reconvene for an informal availability session to discuss the ROD.

Comments Received in Writing

Written comments were received from 3 separate parties. As stated before, the majority of these comments were in support of the preferred alternative, and urged swift implementation. The following are responses to the written comments.

The Michigan Department of Public Health, Interagency Center on Health and Environmental Quality provided the following comments: "We have reviewed the proposed plan and selected alternatives as laid out in the document. The alternative provides for sufficient protection of public health." They recommend the use of injection wells versus seepage basins to avoid the attractive nuisance problem and contaminant diffusion. Another recommendation offered is that it would be economical to combine the treatment systems for the Rasmussen and Spiegelberg sites.

The groundwater treatment alternative using injection wells versus seepage basins was the preferred option for the Rasmussen site. Further investigations into the nature of contamination in the PDSLD and IW soils areas of concern indicated that the re-infiltration system could serve two purposes--that of re-infiltration and flushing. The soil contaminants in this area are largely located just above the water table, and flushing is therefore expected to be protective, effective, and economical. Protective fencing coupled with periodic checking by on-site personnel should protect against trespass.

With regard to combining the systems, among other things, the PRP groups for the two sites are comprised of different entities. The Agencies therefore have to proceed with the remediation of the sites separately, and negotiate the remedial actions for the two sites separately. The PRPs may suggest sharing of equipment between sites if feasible, but this will need to be approved by the Agencies before implementation.

The Livingston County Health Department (LCHD) feels that the chosen alternative for the Rasmussen site ". . .will provide an acceptable solution to the environmental contamination problem at the site." They suggest that residential well monitoring begin immediately, and continue throughout the cleanup project. They ask that monitoring results be provided to residents, Township officials, and the LCHD. They hope work will ". . .commence without delay."

Residential well monitoring is expected to/has re-commence(d) the week of October 22, 1990, and (will) continue at least through remedy implementation. We would prefer to detect groundwater contamination prior to its entering residential drinking water supplies. Monitoring wells placed at varying depths between the known extent of the plume and the residential wells will afford this "early warning" system. Some wells are already present, but a complete monitoring system will be specified with remedy construction. Results of all monitoring will be made available to all of the interests indicated by the LCHD.

PRP Comments

The following were comments submitted on behalf of the Rasmussen Site PRP Group referred to as the Rasmussen Site Steering Committee (RSSC). Submittals during the Public Comment Period were made via two documents: 1) "Misapplication of the Act 307 Rules as ARARs to the Decision Process at the Rasmussen Site", and "Evaluation of Proposed Plan and Recommended Modifications, Rasmussen Site". These documents refer to August 1989 submittals by the RSSC including: 1) "Proposed Remedial Plan, Rasmussen Site", 2) "Assessment of Zinc and Nickel Analyses of Groundwater Samples from the Spiegelberg and Rasmussen Sites, Michigan", 3) "Post Section 106 Removal Public Health Risk Assessment, Spiegelberg and Rasmussen Sites", and an August 1990 document 4) "Proposed Groundwater Cleanup Levels-Rasmussen Site".

<u>The Proposed Plan reflects an improper application of the Michigan Act 307 Rules as ARARs for the following reasons:</u>

1. <u>U.S. EPA has a duty under SARA and the NCP to evaluate whether a state regulation constitutes an ARAR, and if so, U.S. EPA must decide whether and/or how to apply that ARAR.</u>
2. <u>The cleanup criteria in the Proposed Plan constitutes a misapplication of the 307 Rules as ARARs, and as such are inconsistent with Section 121(d)(2)(A) of SARA, the NCP and well-established Superfund guidance and policy.</u>
3. <u>Proper application of the Act 307 Rules would consider Types A, B and C, and an adoption of a combination of cleanup types for this site.</u>
4. <u>Recent proposals including this one, demonstrate that MDNR is recommending an application of the Rules to groundwater cleanups which is inconsistent with specific provisions of the Rules and contrary to senior management policy statements.</u>
5. <u>The Administrative Record's failure to provide justification of the basis for the application of the 307 Rules as ARARs is a violation of due process.</u>

It is true that EPA has a duty to consider whether and how to apply an ARAR to Superfund site cleanups. The State has the responsibility of identifying ARARs, defined as any promulgated standard, requirement, criteria, or limitation, under a state environmental or facility siting law, more stringent than Federal requirements (CERCLA Section 121(d)(2)(A)). In this instance, Michigan Act 307 Rules contain criteria for complying with Type A, B, and C cleanups. The substantive provisions of the Rules, Parts 6 and 7, are considered ARARs for the remedial action to be undertaken for this site. These Rules provide, <u>inter alia</u>, that remedial actions shall be protective of human health, safety, and welfare and the environment and natural resources (Rules 299.5601(1) and 299.5705(1)). The Act 307 Rules specify that this standard is achieved by a degree of cleanup which conforms to one or more of the Types A, B or C cleanup criteria. In this instance, the soil and groundwater cleanup standards and compliance points are based on U.S. EPA's agreement with the State's recommendation of a combination of <u>all</u> <u>three</u> Types of cleanup for this site. With regard to groundwater in particular, U.S. EPA found that, given the present and potential future uses of the groundwater plume, and light of the expectation in the NCP that groundwater be returned to its beneficial uses, 40 CFR

Section 300.430(a)(iii)(F), risk-based cleanup levels consistent with a Type A and B cleanup are appropriate for this site.

Please refer to detailed technical questions and responses below relative to the intricacies of cap design and application of cleanup criteria.

Capping Comments

The acreage of the proposed cap extends significantly beyond the limits of the TML area.

The assertion that the Agencies' proposed cap extends "significantly beyond the limits of the TML area" is correct. However, for an acceptable cap under "closure conditions", several criteria must be met. One of these is to cover adequately the material inside the waste boundary. In addition, proper design (including cap thickness/configuration and slope requirements) must be met for the site. This will require the cap design to extend beyond the TML area. The Agencies would be amenable to review, and if acceptable, approve a cap design which incorporates terracing. This would reduce the lateral extent of the cap. In order to meet relevant and appropriate closure requirements under Michigan Act 64, the cap design for the Rasmussen Site must extend over and beyond the waste in all directions.

The PRPs contend that Act 64 is neither applicable nor relevant and appropriate based on current site conditions.

As stated in the FS, Act 64 is not legally applicable, but as stated, it is relevant and appropriate, as it addresses problems and situations sufficiently similar to those encountered at the site as it currently exists. It is true that the remaining dump materials are primarily municipal garbage, however, post-Section 106 order removal observations by EPA's oversight contractor indicate that visible drums remain. Although the Proposed Plan calls for the removal of drums encountered during capping, a strong likelihood exists that other containerized and potentially hazardous wastes will remain within the capped area. Based on past waste disposal practices, and the dump waste samples taken during the RI, a small portion of the primarily municipal garbage contains hazardous substances of higher toxicity. It is the Agencies' assessment that remaining site conditions are sufficiently similar to, and require the protectiveness of the Act 64 capping requirements.

The RSSC proposes an alternate cap design based on their determination that Act 641 is relevant and appropriate, and that Act 64 is not relevant and appropriate. On pages 8 and 9 of their "Evaluation" document, the RSSC outlines specific remedial components associated with their proposed alternate capping.

As discussed previously, the determination has been made that although dump materials are primarily municipal garbage, some residual hazardous wastes are likely to be present, and therefore Act 64 is relevant and appropriate.

With regard to the bulleted items on pages 8 and 9, the Agencies offer the following comments. The backfilling, terracing and refilling of the Ramsey excavation, and regrading described in bullets one through three are necessary for both the RSSC's and the Agencies' cap designs, and are acceptable proposals. The clay cap proposed in bullet four and depicted in Figure 2.3 is not sufficient to cover all dump wastes as described in the next answer. A perimeter collection drain around the cap to collect surface drainage, as outlined in bullet five, is an acceptable proposal for any capping regime. Bullet six is confusing as it states that ". . .areas outside the limits of the landfill cap would be revegetated for surface water control and to promote stable surfaces." The use of the word "outside" appears to limit revegetation to areas other than the capped area. Revegetation of the entire area is an acceptable proposal, and revegetation of the cap with grasses is required by statute. The final design of the cap will be determined during remedial design and may not include any or may include all of the PRP's "acceptable" proposals.

The RSSC determined that the cap need not extend over the south slopes area because dermal contact risks associated with this area were found to be acceptable, and these areas are heavily vegetated and presently stable.

The proposal for leaving the south slope as is, with existing vegetation growing into the wastes, is unacceptable. The area's wastes are not currently covered with the impermeable layers required for the most lenient of capping specifications under State or Federal requirements, for the protection of the groundwater resource. "Cover" currently consists of sand and gravely soil intermixed with garbage and scrap metal (including pieces of drums, car parts, hot water heaters, etc.). Vegetation growing in these materials over the years has allowed for the build-up of organic materials, promoting further vegetation. These growths consist of 4 to 6 inch diameter trees, sumac, poison ivy, grasses and sedges. Neither groundwater protection nor long-term maintenance considerations are served by leaving the south slope in its current condition.

<u>The RSSC compares their proposed cap design to the cap design outlined in the Agencies' Proposed Plan, with regard to the NCP's 9 evaluation criteria.</u>

i. Overall protection of human health and the environment - The RSSC states that the Agencies' proposed cap design would provide overall protection of human health and the environment in the long-term but not in the short-term. With regard to the short-term allegations, RSSC suggests that grading of wastes onto unaffected soils areas and disturbance of landfill wastes would pose an unacceptable short-term risk. First, the Agencies' preferred capping alternative as outlined in the Proposed Plan does not specifically include the regrading of wastes, although some of this activity <u>may</u> have to be conducted. As outlined, the Agencies' cap is described as constructed over the TML and NEBD areas of concern as they now exist spatially on-site. Secondly, any large scale movement of wastes, if necessary, will be conducted to minimize any potential short-term problems. The problems envisioned by RSSC are the same ones which would have been realized during the CERCLA Section 106 ordered removal activities, where sections of the landfill were excavated and moved to temporary storage areas. No short term risks were encountered.

Furthermore, the RSSC design, lacking cover over all wastes and leaving woody vegetation rooted in wastes, does not conform to this requirement.

ii. Compliance with ARARs - The RSSC states that the Agencies' cap design does not take appropriate measures against erosion to comply with the Michigan Soil Erosion and Sedimentation Control Act (SESCA), but SESCA is an ARAR for this site, as noted in the attached ROD. These measures are not specifically outlined in the Proposed Plan. The Agencies feel that the correct venue for this level of detail is in the Scope of Work leading into design, and the remedial design work plan. Capping must "promote drainage and minimize erosion or abrasion of the cover" (40 CFR 264.310(a)(3)). Measures will be taken within the Agencies' capping proposal to comply with SESCA. Within the realm of design consideration are drainage layers, terracing, and other stormwater management measures.

iii. Long-term effectiveness and permanence - Again, the majority of the issues brought up by RSSC are tied to future design considerations and are not necessarily deficiencies with the Agencies' Proposed Plan. Part of these considerations are terracing and rip-rapped drainage ditches. A properly designed and constructed cap should not suffer from internal erosion (piping). The size of the dump cap area does not necessarily directly relate to its ability to handle stormwater. Larger dumps are routinely capped, with design considerations upscaled for increased water management.

The Agencies' cap was designed with climactic conditions in mind. EPA estimates 30 inches of frost penetration in these areas. It is true that *if* cracking did occur, the 24 inches of topsoil and 6 inches of the clay would be impacted. This still leaves 30 inches of unaffected clay.
RSSC also argues that the 1E-07 cm/sec permeability proposed by the Agencies for clay is susceptible to desiccation cracking due to moisture changes. The clay layer can be kept moist through the Agencies' 24-inch topsoil drainage layer versus RSSC's 30-inch layer.

The 1-foot thick vegetative layer (plus 1-foot thick drainage layer) proposed by the Agencies is intended to provide a zone capable of establishing shallow rooted grasses and maintaining the vegetation so as to stabilize the cap and prevent erosion. The shallow root zone is intended to aid in water uptake and be persistent enough to withstand drought conditions, at design slopes. These grasses would also make O & M of the cap easier. The deep-rooted plants specified by RSSC may adversely affect the integrity of the clay cap in the long term.

iv. Reduction of toxicity, mobility or volume through treatment - This factor is not applicable to capping since no treatment is contemplated.

v. Short-term effectiveness - RSSC's comments on this item are effectively addressed by previous questions, and are largely a function of future design considerations.

vi. Implementability - Implementability of the Agencies' proposed capping regime is questioned due to size and associated time constraints, and easements. Although these are factors to consider, none are prohibitive. Again, size will vary depending on the use of regrading and terracing. Deed restrictions are not a factor of implementability germane to the Agencies' proposal alone, as suggested by RSSC, because any in-place remedy necessitates the use of deed restrictions to insure the integrity of that remedy.

vii. Costs - As outlined in previous questions, assumptions made by RSSC with regard to the Agencies' proposed capping remedy are erroneous. RSSC then uses these assumptions to re-calculate the costs of the Agencies' remedy as they envision it being implemented, and subsequently compare these estimates to that of their proposal. Many of those assumptions lead to overestimates in costs. Assumptions include the use of regrading and that the Agencies' option includes inappropriate erosion control design measures. This portrayal of the Agencies' remedy is not accurate.

The use of costs in remedy selection is for the differentiation of remedies of equal protectiveness and ARARs compliance, which has been considered.

viii. Support agency acceptance - Not applicable to this discussion.

ix. Community acceptance - The RSSC states that "The community has already expressed significant concern regarding the long-term integrity of the Agencies' proposed cap remedy." Contrary to this portrayal, the community clearly expressed concern regarding the long-term integrity of capping remedies in general. It is the concept of in-place disposal which was unpalatable to the surrounding residents, and not the Agencies' proposal in particular.

<u>The RSSC uses the HELP model to compare their proposed cap design to the cap design outlined in the Agencies' Proposed Plan, with regard to hydraulic performance. They also assert that, based on the model, "the RSSC proposed alternate cap design will prove to be superior to the Agencies' Act 64 cap."</u>

As noted by RSSC, the model <u>only</u> illustrates cap effectiveness with regard to infiltration reduction, and does not account for frost or desiccation damage. The results of RSSC's modeling showed the cap designs to be equally effective in reducing infiltration. RSSC's incorrectly concludes that their cap proposal is "superior", since (as they note), the test they employed can not be extrapolated to conclude anything about frost or desiccation damage.

<u>RSSC contrasts the Agencies' proposed cap cost estimates with that of their alternate design.</u>

There may be inaccuracies in the cost estimates for the Agencies' capping remedy, particularly since these estimates were compiled over two years ago and the costs for supply and placement of clay are based on 2 rather than 3 feet of clay as presented in the Proposed Plan. This, and many of the other discrepancies noted by RSSC, will increase the total price proportionally for all remedies considered in the alternatives analysis, but may decrease the unit cost based on quantity. Placement costs for clay associated with "multimedia covers" (Alternatives 4 and 5), are generally higher due to the care needed to be taken protecting the synthetic liner, hence the unit cost difference in the FS.

However, costs may be used to differentiate only between remedies which are protective and meet all ARARs, as noted above. Also faulty assumptions underlie the RSSC's cost comparison, as noted above.

Groundwater Indicator Chemical Comments

"The selection process for indicator chemicals indicated in the Proposed Plan fails to acknowledge the findings from the Agencies' own risk assessment." (Page 26 of the RSSC "Evaluation" document) "Potential carcinogenic risk estimates shown for each chemical in Table 1 of the Proposed Plan effectively assume that a domestic or community supply well would be installed directly in the affected groundwater at the locations of maximum chemical concentrations beneath the Rasmussen site." (Page 29 of RSSC "Evaluation" document) The RSSC recommends eliminating the following four chemicals of concern on the basis of Risk Assessment calculations: bis(2-ethylhexyl)phthalate, 1,1-dichloroethene, tetrachloroethene, and isophorone.

The Agencies' risk assessment was used as the starting point for determining risk posed to potential receptors from the areas of concern. The current selection of chemicals of concern and cleanup levels must also comply with Federal and State ARARs. In this instance, EPA chose the risk-based cleanup levels to meet the expectation in the NCP that groundwater be returned to its beneficial use, 40 CFR Section 300.430(a)(iii)(F), and based on the current and future use scenarios for the affected aquifer. These cleanup levels are consistent with the provisions of Act 307 regarding the removal of hazardous substances from the aquifer (Rule 299.5705(6)).

Of the four chemicals listed above, all except tetrachloroethene remain as chemicals of concern based on their concentrations confirmed during the Agencies' RI, and the comparison of these concentrations with cleanup levels. Tetrachloroethene was estimated at 2.0 ppb in two background sample locations (RA-MW-16 and RA-MW-35), and estimated also at 2.0 ppb in one downgradient location during the same sampling episode (March of 1987). Although this was reported as a positive detection in Table 2-5 of the Risk Assessment, quality control protocols do not hold this one detection as validated data. Tetrachloroethene has been deleted from the list of indicator chemicals.

The RSSC suggests screening out data from the RI based on frequency of detection. They recommend eliminating 1,1-dichloroethene, tetrachloroethene, benzyl alcohol, 2-chlorophenol, and isophorone based on this criteria.

Low frequency of detection is not a valid reason to eliminate chemicals since these data points withstood Quality Assurance/Quality Control. As discussed previously, tetrachloroethene has been eliminated from the list of chemicals of concern for other reasons. Benzyl alcohol has been deleted for the reasons stated later in this document.

The RSSC recommends that the Agencies present the risk results from the Agencies' risk assessment and clarify the "unrealistic" nature of the risk numbers presented in the Proposed Plan.

The risk results from the Risk Assessment are provided in the ROD, along with the sets of assumptions used to calculate these numbers. The Agencies do not feel that the groundwater risk numbers are unrealistic as presented in the Proposed Plan for the potential consumer of the groundwater resource as it exists beneath the Rasmussen site.

By failing to consider a Type C cleanup classification, the Agencies' Proposed Plan makes no allowances for Site-specific conditions and disregards issues of technical feasibility, limitations of analytical chemistry, reasonable and foreseeable uses of the Site, and cost-effectiveness.

As noted in the response to the first RSSC question, the Agencies did not fail to consider a Type C groundwater cleanup. Technical feasibility and limitations of analytical chemistry were considered. Although consistent with a Type A cleanup, chemicals which have a "Basis" for the cleanup criteria noted as "MDL" or method detection limit have taken into consideration, what is achievable by a analytical laboratories. In assessing reasonable and foreseeable uses of the site, the Agencies considered the potential consumer of the groundwater resource at the site in all portions of the aquifer.

As stated earlier, the NCP contemplates that cost will be a differentiating factor only between alternatives which are protective and which comply with ARARs. Similarly, Act 307 Rule 299.5601(3) states that "The cost of a remedial action shall be a factor only in choosing among alternatives which adequately protect the public health, safety, welfare and the environment and natural resources, consistent with the requirements of part 7 of these rules."

RSSC states that the proposed Type B cleanup levels for acetone, 2-butanone, 1,2-dichloroethene, ethylbenzene, 4-methyl-2-pentanone, toluene, 1,1,1-trichloroethane, and xylenes are calculated correctly. However, they did not find that acetone, 2-butanone, 1,2-dichloroethene, 4-methyl-2-pentanone, and 1,1,1-trichloroethane were present above Type B cleanup levels in RSSC sampling rounds.

These chemicals have been detected during previous sampling trips at concentrations exceeding Type B criteria. Chemicals will be included in the indicator chemical list if they have exceeded Type B criteria anywhere on the site at any time. They will not be deleted for the stated reason.

RSSC contends that acetone, bis(2-ethylhexyl)phthalate, 2-

<u>butanone, and methylene chloride are present in site samples due to laboratory contamination.</u>

RSSC's discussion of laboratory contamination can be found throughout the section on groundwater cleanup numbers. Their Table 3.5 compares selected sample data with the corresponding laboratory blank. EPA and MDNR recommend eliminating common laboratory contaminants only if the concentrations in the sample do not exceed ten times the maximum amount detected in any blank.

All of the methylene chloride, acetone, bis(2-ethylhexyl)phthalate and 2-butanone data was reviewed for compliance with this criterion. The results are presented in Appendix A to this Responsiveness Summary. In addition, review included complete analysis of the data validation packages for other indications of poor data quality. Results of the review show that three of the methylene chloride (GW0023, GW0027 and GW0028) data points (previously reported as valid) could not be validated based on the ten times exceedance criteria. All of these data points were from background wells and did not represent the maximum data value reported in Table 1 of the Proposed Plan. One acetone data point (GW006) failed the validation criteria. This sample was not the maximum reported value from Table 1. Two of the bis(2-ethylhexyl)phthalate sample analyses (GW006 and GW011) were qualified as having the compound in the blank (B), but review of the validation package showed non-detect in the blank. These two concentrations were valid. One 2-butanone sample (GW016) exceeded the CLP required holding time, and was found invalid. Two were noted as having low recovery factors in the spike, one (GW004A) was subsequently validated, the other (GW0079) was not. Based on these results, the presence of the four chemicals in question could not be attributed to laboratory contamination, and will remain as chemicals of concern for the Rasmussen groundwater plume.

Investigations into the sample points reported in Table 3.5 of the RSSC comments could not substantiate any of the data listed therein.

<u>RSSC contends that benzyl alcohol should be deleted from the chemical of concern list because they could not confirm the chemical in their sampling rounds.</u>

The risk-based cleanup for benzyl alcohol was incorrectly reported as 9 ppb. The correct risk-based level, which is consistent with the Type B cleanup level, is 10 ppm (10,000 ppb) based on data from the National Toxicology Program bioassay (1989). The reported concentrations of benzyl alcohol (12 ppb) do not exceed the cleanup level; therefore, benzyl alcohol should be removed from the list of chemicals of concern.

<u>RSSC contends that the HLSC for chlorobenzene should be 100 ppb</u>

which is consistent with U.S.EPA's Final Lifetime Health Advisory and based on an alternate literature citation for the taste and odor threshold.

The data from Amoore and Hautala (1983) was chosen to establish aesthetics criteria because it is a well-recognized, quality study. The threshold odor concentration (TOC) of 100 ppb reported in Verschueren (1983) is based on two German articles that are not available for review. EPA has relied on Amoore and Hautala (1983) for establishing Secondary Maximum Contaminant Levels. The cleanup level for chlorobenzene will remain at 50 ppb based on the Amoore and Hautala (1983) citation.

The RSSC states that the Agencies arbitrarily cited the lowest literature taste and odor threshold for 2-chlorophenol, and should have chosen the HLSC of 40 ppb as the cleanup level.

The selection of the 0.1 ppb as the aesthetics criterion is based on the data in Verschueren. These data are reported as an odor threshold of 0.18 ppb and a taste threshold ranging from 0.1 to 6.0 ppb. Since the odor threshold is reported at 0.18 ppb, a concentration of 0.1 ppb should protect against both adverse taste and odor effects. An acceptable method detection limit (MDL) for 2-chlorophenol is 5 ppb. Since the aesthetics criterion is less than the MDL, the MDL becomes the cleanup goal. The cleanup level for 2-chlorophenol is 5 ppb. However, since the aesthetics criterion is significantly less than the MDL, an attempt to evaluate the aesthetics of the remediated groundwater should be made.

RSSC contends that the cleanup level for 1,1-dichloroethene should be set at the MCL/MCLG level of 7 ppb rather than based on its suspected carcinogenicity.

The Agencies are currently reviewing the carcinogenicity data for 1,1-DCE to determine if it should continue to be regulated as a carcinogen. Since the State has historically regulated 1,1-DCE as a carcinogen, they will continue to do so until the toxicological review is completed. The cleanup level for 1,1-DCE remains at 1.0 ppb.

The RSSC contends that the Agencies' selection of a cleanup level for 2,4-dimethylphenol based on a detection limit (1 ppb) should have been based on the draft HLSC of 140 ppb.

Further information has recently become available with respect to 2,4-dimethylphenol. An oral RfD became available in IRIS as of November 1, 1990. The new risk-based cleanup level, consistent with a Type B cleanup, is 100 ppb. Since the health-based value is lower than the aesthetics criteria of 400 to 500 ppb, 100 ppb is the final cleanup level. The Agencies have deleted 2,4-dimethylphenol from the list of indicator chemicals for the

Rasmussen site as the maximum concentration detected at the site is 27 ppb, which is below the cleanup level.

<u>The RSSC contends that the Agencies should have based cleanup levels for 2-methylphenol and 4-methylphenol on HLSC values rather than on taste and odor thresholds.</u>

The aesthetics data for 2-methylphenol and 4-methylphenol have been re-evaluated. Verschueren (1983) reports the following aesthetics data for 2-methylphenol in water:

Parameter	Concentration	Reference number
odor threshold (tentative):	average: 0.65 mg/l (ppm) range: 0.016 - 4.1 mg/l	(294)(97)
TOC in water:	0.09 ppm 0.65 ppm	(326)
TOC in water:	0.26 ppm	(325)
odor threshold:detection:	1.4 mg/l	(998)
Taste threshold concentration:	0.003 mg/l	(998)

Reference 998 is a German article unavailable for review, therefore, the Agencies' original decision to use this article for development of the aesthetics criterion was inappropriate. The Agencies are currently using reference 325 entitled "Odor thresholds of mixed organic chemicals" by A. A. Rosen, et.al. (1962) to develop the criterion. The threshold developed by Baker (Reference 294) is a tentative value and the data reported by Stahl (Reference 326) is a compilation of data and includes the data of Baker. The study by Rosen (1962) is a well-conducted study. Threshold odor concentrations (TOC) for several compounds were generated using a panel of 11 to 16 judges taken from a pool of 20 people. The geometric mean is reported as the TOC. The risk-based Type B criterion for 2-methylphenol is 300 ppb (260 rounded to 1 significant figure).

The only data reported for 4-methylphenol is a taste threshold concentration of 0.002 mg/l and an odor threshold (detection) of 0.2 mg/l from the previously mentioned reference 998. Since inadequate aesthetics data exists for this chemical, the Agencies relied on the HLSC as the risk-based cleanup level, which also meets the Type B criterion. However, since adverse aesthetics are associated with the phenolic compounds, an attempt to evaluate the aesthetics for 400 ppb of 4-methylphenol is recommended. Since the maximum reported concentration of 4-methylphenol is 280 ppb, it is deleted from the list of indicator chemicals.

<u>The RSSC reiterates their contention that the Agencies' proposed cleanup levels for both benzene and vinyl chloride do not consider Type C criteria including technical limitations of analytical chemistry, technical limitations of remedial technologies, and cost-effectiveness. RSSC recommends the following cleanup levels: 5 ppb for benzene and 2 ppb for vinyl chloride.</u>

The Agencies continue to stand behind the risk-based, Type B criteria used for these two cleanup levels. Previous responses deal with the issues of Type C criteria consideration. Final MDLs issued by the Department include 1.0 ppb for vinyl chloride (previously reported as 0.5 ppb).

Most commercial laboratories using GC methodology can detect the required cleanup levels of 1.2 ppb and 1.0 ppb benzene and vinyl chloride, respectively. A few laboratories using GC/MS will also achieve these levels. Either technique is appropriate provided the MDL is adequate.

<u>RSSC feels that the cleanup level set for tetrachloroethene should be set at the proposed MCL of 5 ppb rather than at the 2 ppb level for potential carcinogenic risk.</u>

The maximum concentration of tetrachloroethene was incorrectly reported as 2.0 ppb as described in the first response in this section. Tetrachloroethene will be deleted as a chemical of concern for the Rasmussen groundwater plume.

<u>According to RSSC, trichloroethene should have a cleanup level of 5 ppb based on the Federal MCL, rather than the 1.0E-06 carcinogenic risk number of 3 ppb. Review of the RI and RSSC subsequent sampling data has confirmed the presence of trichloroethene in the vicinity of RA-MW-27. The RSSC proposes installing a supplemental groundwater extraction well near this location for the purpose of groundwater cleanup.</u>

The Agencies believe it is necessary to establish risk-based cleanup levels for the site. The basis for the selection of these cleanup levels is provided in CERCLA Section 121 and the NCP. In order to protect human health and the environment, under CERCLA and the NCP, a risk-based cleanup has been established for groundwater. A risk-based cleanup is necessary due to the close proximity of residential wells and the potential future use of groundwater at and near the site.

The NCP requires a site be remediated to within a 10^{-4} to 10^{-6} risk range. In order to achieve a level of acceptable risk at the site, due to the number of carcinogenic contaminants detected at the site, cleanup levels were established at a 10^{-6} risk level rather than at the MCLs or the non-zero MCLGs.

The risk-based, Type B cleanup level of 3.0 ppb for trichloroethene is associated with an increased cancer risk of 1.0E-06 which the Agencies consider an acceptable level of risk, and which serves as the basis for regulating carcinogens. The cleanup level for trichloroethene, which is consistent with the Type B criterion, will remain at 3.0 ppb.

<u>RSSC contends that lead is not an indicator chemical for the Rasmussen site because their sampling rounds have shown on-site concentrations to be less than background levels, and dissolved lead in these samplings was detected below the HLSC of 10 ppb. They contend that the MDNR interim RfD calculation which produces a cleanup level of 5 ppb is inappropriate.</u>

Appendix B attached hereto is further rationale for developing a risk-based Type B criterion of 5 ppb for lead. The basis for this criterion is not specifically inhalation exposure, but rather a blood lead level produced by a variety of exposures. The Acceptable Daily Intake (ADI) developed several years ago by EPA is out of date and inappropriate to use. EPA states in IRIS: "By comparison to most other environmental toxicants, the degree of uncertainty about the health effects of lead is quite low. It appears that some of these effects, particularly changes in levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood levels so low as to be essentially without a threshold." Since development of the ADI, lead has also been classified as a probable human carcinogen. As a result, it is appropriate to use an approach that takes these factors into account and yields a more conservative estimate than the ADI developed several years ago.

If design studies (and split samplings) show that either 1) on-site filtered lead samples are less than 5 ppb, or 2) on-site filtered lead samples are greater than 5 ppb but less than background filtered lead levels, then lead may be deleted from the list of chemicals of concern.

<u>The RSSC suggests the deletion of cadmium as a chemical of concern based on comparisons with background levels and that dissolved levels meet the Agencies' cleanup levels.</u>

The cleanup level for cadmium will remain at 4.0 ppb. Like lead, if design studies (and split samplings) show that either 1) on-site filtered cadmium samples are less than 4 ppb, or 2) if on-site filtered cadmium samples are greater than 4 ppb but less than filtered cadmium levels, then cadmium may be deleted from the list of chemicals of concern.

<u>RSSC contends that method detection limits (MDLs) should be</u>

changed to practical quantitation limits (PQLs) for 1,1-dichloroethene, 2,4-dimethylphenol, and vinyl chloride, benzene, 2-chlorophenol, 2-methylphenol, 4-methylphenol, and tetrachloroethene.

The primary difference between the MDL and the PQL is that the MDL is a detection limit, and the PQL is a quantitation limit. The detection limit is a measure of when an analytical system indicates that a substance is present above a certain limit, there is a 99 percent probability that the substance is present, but not necessarily at the reported level. The PQL is established at a level above the MDL where quantitative certainty is higher. PQL is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. U.S. EPA developed the PQL concept to define a measurement concentration that is time and laboratory independent for regulatory purposes. The U.S. EPA estimates that the PQLs are 5 to 10 times higher than the MDLs.

MDLs are more appropriate than PQLs as a lower detection limit on target cleanup levels because:

1) MDLs extend the analytical range to lower levels based on presence/absence of a contaminant. If a target cleanup level is below the MDL and lab analysis confirms the presence of a contaminant above the MDL, then the cleanup level has not been achieved.

2) Although it is true that more quantitative uncertainty exists with MDLs than PQLs, this uncertainty is reduced through reliance on multiple samples.

3) In the absence of a large interlaboratory study to identify the PQL, the PQL defies precise definition. The PQL can only be estimated from the MDL using the 5 to 10 factor. MDLs can be determined for a single laboratory using a specific instrument and a specific analyst.

Cleanup levels for these eight chemicals will not change based on the PQL vs. MDL consideration. However, noted above are the changes/deletions for some of these chemicals based on other considerations.

Groundwater treatment Technology and Cost Comments

"The removal of heavy metals as a process option has already been eliminated based on the determination. . .that lead and cadmium are not appropriate indicator chemicals."

Recommendations by the PRPs that chemical precipitation for lead and cadmium removal are not necessary, will be accepted, provided that the claim that these metals are not present in the groundwater above filtered background levels is substantiated. If necessary for the functioning of the balance of the treatment system, a filter system for particulate removal may need to be considered, even if the cleanup standards for lead and cadmium are not triggered.

RSSC contends that biological treatment is not technically feasible at the Rasmussen Site. Secondly, biological treatment is not warranted based on RSSC sample data.

Discussions with manufacturers of treatment technologies and an operator knowledgeable in the field of groundwater treatment indicate that the selected technologies are capable of achieving the required cleanup levels of the compounds at the influent concentrations. Review of treatability data indicates that with the exception of xylene and 2-methylphenol, all compounds could be remediated to the stated target cleanup level by biological (activated sludge) and aqueous phase carbon adsorption. With the addition of air stripping, mean cell residence time would be significantly reduced and would allow for down-sizing of the biological treatment equipment. Biological treatment systems are designed on the basis of the total amount of organics present in the groundwater. This would be determined by the ratio of BOD:COD:TOX, which would be quantified during the treatability study (design).

It is a common procedure to add supplemental nutrients and/or oxygen to maintain an optimum environment for the microbes. Additionally, if a contaminant concentration is sufficiently low that the microbes do not recognize it as food, an innocuous co-metabolite can be introduced to enhance the microbes metabolism of the contaminant.

It should be noted that biological treatment systems have many advantages over conventional physical/chemical treatment processes. Advantages include: multiple organics contaminants can be treated simultaneously; unlike conventional treatment methods, biological units are completely destructive, thereby eliminating the requirements of disposing of the concentrated contaminant waste streams; and, biological units are inexpensive relative to conventional treatment methods (eg. 1/20 of the cost of carbon adsorption and air stripping with vapor emission controls).

A 360-degree groundwater monitoring program around the dump for all parameters at both on- and off-site locations is unwarranted due to cost and consideration of site hydrogeology, according to the RSSC.

Groundwater monitoring of site closure under Act 64 requires compliance with 40 CFR Part 264 subpart F. This subpart requires a groundwater system that consists of a sufficient number of wells representing background water quality and allows for detection of contamination when hazardous wastes or constituents have migrated from the waste management area. It is implied, therefore, that the detection system be constructed so that potential migration in any direction be intercepted.

Monitoring of off-site residential wells would be duplicative and is unnecessary, according to RSSC.

The Livingston County Health Department has the responsibility for ensuring that residential water supplies are safe to consume. A major concern of the LCHD was that a safe water supply be provided to the area. They suggested that alternate public water be provided to the area around the two Superfund sites, as municipal supplies are generally monitored more closely (frequently) than residential supplies. The feasibility of this was evaluated along with other alternatives. It was determined that regular monitoring of the existing residential supplies, until remediation could be assured, was the preferred alternative. Toward that end, MDNR is currently arranging for the sampling of residential wells to be conducted contractually. Any agreement for remediation will also include the perpetuation of this monitoring until groundwater cleanup at the site has been achieved.

ATTACHMENT

The community relations activities conducted at the Rasmussen site to date are listed below. A key to abbreviations follows.

DATE OF ACTIVITY	TYPE OF ACTIVITY	PARTICIPANTS
1967 and 1968	Citizen Reports Complaints Dumping and Burning	Citizen, MDPH, LCHD
March 5, 1981	Citizen Complaint Triggers Action	Citizens, LCHD
February 1983	PIRGIM Meeting	Citizens, PIRGIM
February 14, 1983	PIRGIM Letter to MDNR	PIRGIM, MDNR
February 25, 1983	Meeting	PIRGIM, Citizens, MDNR, LCHD
March 1983	Citizen's Letter to TSCC	Citizens, TSCC
April 1983	Public Meeting	SCARE, MDPH
May 1983	Citizens ACTION Formed	All Interested
July 29, 1983	Task Force Meeting	LCHD, MDA, MDNR, Citizens, Twp., MDPH, TSCC, Senator, Reps.,
September 12, 1983	Task Force Meeting	Reps., Senator, LCHD, Citizens, Commission., MDPH, MDNR
October 17, 1983	Newsletter #1	U.S.EPA, MDNR
December 19, 1983	Task Force Meeting	Reps., Senator, Commission., Twp., LCHD, Citizens, TSCC, MDPH, U.S.EPA
January 6, 1984	Task Force Meeting	LCHD, Citizens, Commission., Senator,
U.S.EPA,		MDNR
January 23, 1984	Monthly Info. Bull. #1	MDNR

March 12, 1984	CIC Meeting	Citizens, LCHD, U of M, MDNR, Commission., U.S.EPA, MDPH, Twp., TSCC, Reps.
April 23, 1984	Info Sent to Task Force	MDNR
April 24, 1984	Monthly Info. Bull. #2	MDNR
May 24, 1984	Newsletter #2	U.S.EPA, MDNR
June 1984	Information Repositories Opened	U.S.EPA, MDNR
June 7, 1984	CIC Meeting	Citizens, MDNR, TSCC, Twp., MDPH, LCHD, Senator, U.S.EPA
June 29, 1984	Newsletter #3	U.S.EPA, MDNR
July 17, 1984	CIC Meeting	LCHD, Citizens MDNR, WQB, Twp., Commission., Hamburg Twp.
July 19, 1984	Public Info Meeting	U.S.EPA, MDNR, LCHD, Citizens, NUS, Fire Dept.
August 31, 1984	Monthly Info Bull. #3	MDNR
September 27, 1984	CIC Meeting	MDNR, LCHD, Citizens, TSCC
October 11, 1984	Special Notice	U.S.EPA, MDNR
October 25, 1984	Issuance of Community Relations Plan	U.S.EPA, MDNR
October 30, 1984	Community Toxicology Presentation	MDNR, U.S.EPA, MSU
November 3, 1984	Newsletter #4	U.S. EPA, MDNR
November 9, 1984	CIC Meeting	LCHD, SEMCOG, MDNR, Citizens, Twp.

November 27, 1984	Newsletter #5	U.S.EPA, MDNR
December 3, 1984	CIC Meeting	LCHD, Citizens, Twp., MDNR, NUS, Media, U.S.EPA, TSCC
January 7, 1985	CIC Meeting	Citizens, LCHD, MDNR, U.S.EPA, Twp.
January 24, 1985	CIC Effectiveness Survey	U of M, MDNR
January 30, 1985	Newsletter #6	U.S.EPA, MDNR
February 4, 1985	CIC Meeting	MDNR, Citizens, TSCC, MDPH, Twp., LCHD, NUS
March 29, 1985	Newsletter #7	U.S.EPA, MDNR
April 1, 1985	CIC Meeting	Citizens, MDNR, TSCC, LCHD, MDPH, Twp., Commission.
May 31, 1985	Newsletter #8	U.S.EPA, MDNR
July 1, 1985	CIC Meeting	Citizens, MDNR, Twp., LCHD, MDPH
September 13, 1985	Newsletter #9	U.S.EPA, MDNR
December 5, 1985	Newsletter #10	U.S.EPA, MDNR
December 10, 1985	CIC Meeting	LCHD, MDNR, Twp., Citizens, MDPH, NUS, Fire Dept, U.S.EPA
July 24, 1986	Newsletter #11	U.S.EPA, MDNR
September 8, 1986	Progress Report	U.S.EPA, MDNR
August 7, 1987	Newsletter #12	U.S.EPA, MDNR
November 3, 1987	Newsletter #13	U.S.EPA, MDNR
November 9, 1988	Newsletter #14	U.S.EPA, MDNR

November 14, 1988	CIC Meeting	U.S.EPA, MDNR
June 16, 1989	Newsletter #15 (Mostly Spiegelberg Info)	U.S.EPA, MDNR
June 27, 1989	Public Meeting on Spiegelberg Removal, Some Rasmussen Discussion	U.S.EPA, MDNR Citizens, LCHD, Twp., PRP Rep.
August 1989	Establish Local Call-in	MDNR
August 21, 1989	Newsletter #16 (Mostly Spiegelberg Info)	U.S.EPA, MDNR
October 30, 1989	Newsletter #17 (Mostly Spiegelberg Info)	U.S.EPA, MDNR
February 8, 1990	Informal Public Meeting	MDNR, U.S.EPA, Citizens, LCHD, Twp., PRP Rep.
May 18, 1990	Newsletter #18	U.S.EPA, MDNR
July 18, 1990	Newsletter #19	U.S. EPA, MDNR
July 24, 1990	Newsletter #20	U.S.EPA, MDNR
July 31, 1990	Informal Public Meeting	MDNR, U.S.EPA, Citizens, LCHD, Twp., PRP Rep.
August 31, 1990	Proposed Plan Sent Out PCP Open	U.S. EPA, MDNR
August 31, 1990	Newsletter #21	U.S.EPA, MDNR
September 13, 1990	Public Meeting on Proposed Plan and FS	Citizens, LCHD, MDNR, U.S.EPA, PRP Rep.
October 31, 1990	PCP Closed	U.S.EPA, MDNR
December 5, 1990	Newsletter #22	U.S.EPA, MDNR

The items listed above, where appropriate, are in the Administrative Record. All other items can be found as part of the Michigan Department of Natural Resources, Environmental Response Division, Superfund Section's Files. In addition, correspondences with individual citizens and PRPs are contained in the records. As part of the community relations efforts, numerous Freedom of Information Act requests were filled, and the

Information Repository received updated information when available.

Key to Abbreviations for Attachment

Citizens	- Local Citizenry
Commission	- Commissioner's Office
CIC	- Citizen's Information Committee
Fire Dept.	- Township Fire Department
Hamburg Twp.	- Hamburg Township Representative
LCHD	- Livingston County Health Department
MDA	- Michigan Department of Agriculture
MDNR	- Michigan Department of Natural Resources
MDPH	- Michigan Department of Public Health
Media	- Media Representatives
MSU	- Michigan State University
NUS	- State Contractor NUS Corporation
PCP	- Public Comment Period
PIRGIM	- Public Interest Research Group of Michigan
PRP Rep.	- Representative of Potentially Responsible Parties
Reps.	- State Representative's Office
SCARE	- Safe, Clean and Revitalized Environment (Group)
SEMCOG	- South(E)ast Michigan Council of Governments
Senator	- Representative of Senator's Office
TSCC	- Toxic Substance Control Commission
Twp.	- Green Oak Township Representative
U of M	- University of Michigan
U.S.EPA	- United States Environmental Protection Agency
WQB	- Water Quality Board

APPENDIX A

COMPARISON OF FIELD AND LABORATORY BLANK SAMPLES WITH GROUNDWATER SAMPLE CONCENTRATIONS (IN PPB) FOR THE RASMUSSEN SITE (TAKEN FROM RI REPORT RESULTS AND DATA VALIDATION PACKAGES)

METHYLENE CHLORIDE

RI GROUNDWATER SAMPLE ID	TRAFFIC REPORT	CASE #	GROUNDWATER SAMPLE CONCENTRATION	FIELD BLANK CONCENTRATION	LABORATORY BLANK CONCENTRATION	NOTES	DATA VALID (Y OR N)
GW 001	E9348	3675	5 J	5 RJ	ND		Y
GW 002	E9349	3675	130	5 RJ	ND		Y
GW 003	E9350	3675	5 J	5 RJ	ND		Y
GW 004	E9379	4050	100 JB	5 RJB	ND		Y
GW 004A	E9398	4050	150 B	5 RJB	ND		Y
GW 0023	EF485	4758	3000 B	5 RJB	ND	DUPLICATE	Y
GW 0027	EF490	4758	6500 B	110 UJB	12000	< 10X LB	N
GW 0028	EF491	4758	10000 B	110 UJB	12000	< 10X LB	N
GW 0029	EF044	4964	249 B	110 UJB	12000	< 10X LB	N
GW 0029A	EF045	4964	161 B	5 UJB	7	> 10X LB	Y
GW 0040	EF496	5155	1100 JB	5 UJB	7	> 10X LB	Y
				2 UJB	3	> 10X LB	Y

ACETONE

RI GROUNDWATER SAMPLE ID	TRAFFIC REPORT	CASE #	GROUNDWATER SAMPLE CONCENTRATION	FIELD BLANK CONCENTRATION	LABORATORY BLANK CONCENTRATION	NOTES	DATA VALID (Y OR N)
GW 004	E9397	4050	200 JB	10 RJB	ND		Y
GW 004A	E9398	4050	200 B	10 RJB	ND	DUPLICATE	Y
GW 006	EA819	4174	110 B	ND	14	< 10X LB	N
GW 008	EC041	4174	26000 B	ND	14	> 10X LB	Y
GW 017	EC078	4361	790	ND	8.1	> 10X LB	Y
GW 040	EF496	5155	9500 B	11 UJB	11	> 10X LB	Y

KEY TO NOTATIONS ON 3 RD PAGE.

APPENDIX A CONTINUED

COMPARISON OF FIELD AND LABORATORY BLANK SAMPLES WITH GROUNDWATER SAMPLE CONCENTRATIONS (IN PPB) FOR THE RASMUSSEN SITE (TAKEN FROM RI REPORT RESULTS AND DATA VALIDATION PACKAGES)

BIS(2-ETHYLHEXYL)PHTHALATE

RI GROUNDWATER SAMPLE ID	TRAFFIC REPORT	CASE #	GROUNDWATER SAMPLE CONCENTRATION	FIELD BLANK CONCENTRATION	LABORATORY BLANK CONCENTRATION	NOTES	DATA VALID (Y OR N)
GW 005	EC034	4126	4	ND	ND		Y
GW 006	EA819	4174	16 B	ND	ND	ANOMALY	Y
GW 011	EC045	4174	12 B	ND	ND	ANOMALY	Y
GW 029	EF044	4964	24	ND	ND		Y
GW 029A	EF045	4964	18	ND	ND	DUPLICATE	Y
GW 052	ED930	5959	2 J	ND	ND		Y

2-BUTANONE

RI GROUNDWATER SAMPLE ID	TRAFFIC REPORT	CASE #	GROUNDWATER SAMPLE CONCENTRATION	FIELD BLANK CONCENTRATION	LABORATORY BLANK CONCENTRATION	NOTES	DATA VALID (Y OR N)
GW 001	E9348	3675	60	ND	ND		Y
GW 003	E9350	3675	46	ND	ND		Y
GW 004A	E9398	4050	600 J	ND	ND	LOW RF	Y
GW 008	EC041	4174	74000 B	ND	8.2	> 10X LB	Y
GW 016	RASMU	RASM	22 J	ND	ND	HOLD TIME	N
GW 017	EC078	4361	180	12 UJB	8.9	> 10X LB	Y
GW 040	EF496	5155	18000 B	11 UJB	11	> 10X LB	Y
GW 079	EK850	7016	11 RJB	ND	ND	LOW RF	N

KEY TO NOTATIONS ON 3 RD PAGE.

APPENDIX A CONTINUED

COMPARISON OF FIELD AND LABORATORY BLANK SAMPLES WITH GROUNDWATER SAMPLE CONCENTRATIONS (IN PPB) FOR THE RASMUSSEN SITE (TAKEN FROM RI REPORT RESULTS AND DATA VALIDATION PACKAGES)

KEY TO NOTATIONS

GW = GROUNDWATER
PPB = PARTS PER BILLION
RI = REMEDIAL INVESTIGATION
ND = NOT DETECTED
LB = LAB BLANK
LOW RF = LOW RECOVERY FACTOR FOR LABORATORY SPIKE
DUPLICATE = DUPLICATE SAMPLE (eg. GW 004 AND GW 004A, GW004A IS THE DUPLICATE)
< 10X LB = RI DATA IS LESS THAN 10 TIMES LAB BLANK DATA, NOT VALID
> 10X LB = RI DATA IS GREATER THAN 10 TIMES LAB BLANK DATA, VALID
HOLD TIME = SAMPLE WAS NOT ANALYZED WITHIN REQUIRED TIME LIMIT AFTER COLLECTION
ANOMALY = DATA QUALIFIED BUT NO EVIDENCE OF WHY UPON REVIEW

DATA QUALIFIERS:

R = DATA IS UNUSABLE, COMPOUND MAY OR MAY NOT BE PRESENT
J = ASSOCIATED NUMERICAL VALUE IS AN ESTIMATED QUANTITY
U = ANALYZED FOR BUT NOT DETECTED
B = FOUND IN BLANK
UJ = ANALYZED, NOT DETECTED, NUMERIC VALUE IS ESTIMATED AS QUALITY CONTROL NOT MET

APPENDIX B

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LEAD

TYPE B CRITERIA

JUSTIFICATION AND RATIONALE

The recommendation for lead cleanup goals in residential areas is local background for soil and 5 ppb for groundwater. Following is a discussion of the health issues surrounding lead and justification for this recommendation.

Lead has been classified by EPA as a probable human carcinogen based on sufficient animal data. However, a quantitative estimate of carcinogenic risk from oral exposure is not available. The following statement is provided in EPA's Integrated Risk Information System (IRIS):

> "Quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden and exposure duration influence the absorption, release, and excretion of lead. It is also felt that current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used."

Without a quantitative estimate of carcinogenic risk for lead, it is impossible to calculate cleanup criteria according to routine procedures.

Lead is also a significant concern in terms of its noncarcinogenic effects. Effects associated with lead toxicity include: 1) inhibition of pyrimidine-5-nucleotidase (Py-5-N) and delta-aminolevulinic acid dehydrase (ALA-D) activity. Inhibition of ALA-D in the brain is associated with the gamma-aminobutyric acid (GABA) neurotransmitter system in various ways. 2) interference in heme synthesis throughout the body. 3) interference with vitamin D metabolism. 4) changes in electrophysiological functioning of the nervous system. 5) delays in early cognitive and physical development of fetuses and young children. 6) deficits in IQs of children. The last two effects have been receiving considerable attention lately since these effects occur at very low blood dose levels and since some of the neurobehavioral effects may not be reversible. The following language appears in IRIS:

> "By comparison to most other environmental toxicants, the degree of uncertainty about the health effects of lead is quite low. It appears that some of these effects, particularly changes in the levels of certain blood enzymes and in aspects of children's neurobehavioral development, may occur at blood lead levels so low as to be essentially without a threshold. The Agency's Reference Dose (RfD) Work Group discussed inorganic lead (and lead compounds) at two meetings (7/8/85 and 7/22/85) and considered it inappropriate to develop an RfD for inorganic lead."

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EPA is considering an alternative to the RfD approach for lead. (The RfD is a dose in units of mg/kg of body weight per day which is not expected to cause any adverse noncarcinogenic health effects.) The alternative is an Exposure Uptake Biokinetic Model which estimates a blood lead level associated with specific exposure assumptions. EPA is also expected to announce an acceptable blood lead level. With this information, the hazards associated with a particular site can be determined. This model will also allow us to estimate environmental concentrations which are acceptable (based on an acceptable blood lead level).

In September of 1989, the Office of Solid Waste and Emergency Response (OSWER) of EPA provided Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites. Their directive states that a soil lead concentration of 500 to 1,000 ppm is considered protective for direct contact at residential settings. This guidance is based on a 1985 recommendation by the Center for Disease Control (CDC). At the time of the CDC publication, the blood lead level of concern was 25 ug/dl. Recently CDC's Childhood Lead Poisoning Prevention Ad Hoc Advisory Committee recommended that the toxicity threshold be lowered to 10 ug/dl or more.

Until EPA provides updated guidance, an interim approach was developed to estimate safe/acceptable soil concentrations for lead. Acceptable soil concentrations were generated for three different residential populations; children without pica, children with pica and the adult. An acceptable soil concentration was also developed for the industrial scenario. The soil concentrations were calculated by plugging the different exposure assumptions into the direct contact equation presented in the 307 Rules. As a result, these concentrations are expected to be protective for the ingestion and dermal absorption of contaminants in soil. They do not address the issue of impact to the groundwater.

The toxicological endpoint for my calculations is an acceptable blood lead level of 5 to 10 ug/dl based on the recommendation of the CDC Committee. This was converted to an acceptable daily dose (mg/kg/day) by using the following assumptions:

- -average adult body weight is 70 kg
- -average body weight of a 1-6 year old child is 16 kg
- -blood volume for an adult is 56 dl
- -blood volume for a child (1-6 years old) is 12.6 dl
- -variation in sensitivity of the human population justifies the use of a 10-fold uncertainty factor which reduces the acceptable dose by one-tenth

The above assumptions produce an acceptable daily intake (ADI) for lead of 0.4 to 0.8 ug/kg/day for both adults and children. This ADI does not take into account the carcinogenicity of lead. A discussion of the exposure assumptions used for the soils calculations follows.

EPA has recommended using a soil ingestion rate of 200 mg/day for children without pica and 100 mg/day for adults. For children with pica, a rate of 1,000 mg/day is used which represents an upper range estimate of children with a higher tendency to ingest soil materials. Assuming

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that children are exposed to soils only six months out of the year, the average daily soil ingestion rate for children without pica is 100 mg/d and 500 mg/d for children with pica. Assuming the same 6/12 month exposure for adults, their daily soil ingestion rate becomes 50 mg/d. The same soil ingestion rate was used for industrial workers to protect those individuals that may be working outdoors on exposed soils. Assuming their exposure is for 5 out of 7 days and 6 out of 12 months over 45 years, the average soil ingestion rate is 20 mg/d.

A dermal dose of 0.5 g/d was used for children assuming the following:

-in the outdoor scenario, young children have 0.178 m2 of skin exposed
(this includes hands, forearms and legs below the knees)
-5,120 mg soil comes into contact with each m2 of skin
-when indoors, 0.04 m2 of skin (just hands) comes into contact with dust
-560 mg house dust contacts every square meter of skin
-80% of house dust is composed of outdoor soils

Multiplying skin surface area by amount of soil on skin results in a total of 911 mg outdoor soils and 22 mg indoor dust contacting the skin. Assuming six months of exposure per year to outdoor soils and 80% of indoor dust is composed of outdoor soils, the total amount of soil on skin for the younger child is 691 mg. Divide this by 1,460 days (365 days X 4 years) and the final dermal dose for young children is 0.5 grams/d.

A dermal dose of 1 gram/d for adults was derived using the following assumptions:

-when gardening, adults have 0.197 square meters of skin exposed to the
soil (hands and forearms)
-35,000 mg/m2 soil gets on the skin during gardening
-in the indoor situation, 0.082 m2 of skin (hands) comes into contact with house dust
-560 mg/m2 house dust comes into contact with the hands
-80% of house dust is comprised of outdoor soils
-adults garden 6 months out of the year, 2 days out of the week

These assumptions determine that over a 60 year period (excluding the first 10 years of life) adults are exposed to 21,572 grams of outdoor dirt and 806 grams of indoor dust. The total divided by 21,900 days equates to an adult dermal dose of 1 gram/d.

For the industrial scenario, a dermal dose of 0.4 g/d was calculated assuming that workers have 0.197 m2 skin surface area exposed (hands and forearms) and 5,120 mg/m2 soil comes into contact with the skin. Assuming exposure 5 out of 7 days and 6 out of 12 months over 45 years, the final worker dermal dose can be calculated.

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APPENDIX B

The resulting calculations and soil concentrations are presented below:

Children without pica: $\frac{0.4\text{-}0.8 \text{ ug/kg/d} \times 16 \text{ kg} \times 0.2 \times 1000}{[(0.1 \text{ g} \times 0.5) + (0.5 \text{ g} \times 0.01)]}$ = 23-46 ppm

Children with pica: $\frac{0.4\text{-}0.8 \text{ ug/kg/d} \times 16 \text{ kg} \times 0.2 \times 1000}{[(0.5 \text{ g} \times 0.5) + (0.5 \text{ g} \times 0.01)]}$ = 5-10 ppm

Adults: $\frac{0.4\text{-}0.8 \text{ ug/kg/d} \times 70 \text{ kg} \times 0.2 \times 1000}{[(0.05 \text{ g} \times 0.5) + (1.0 \text{ g} \times 0.01)]}$ =160-320 ppm

Industrial: $\frac{0.4\text{-}0.8 \text{ ug/kg/d} \times 70 \text{ kg} \times 0.2 \times 1000}{[(0.02 \text{ g} \times 0.5) + 0.4 \text{ g} \times 0.01)]}$ =400-800 ppm

As discussed in the 307 Rules, the 0.2 value represents the assumption that a person only receives 20% of their exposure to lead from soil. The value of 1000 is a conversion factor.

In order to protect children, the most sensitive subgroup of our population, a soil cleanup criterion of background is recommended for residential areas. In industrial situations, it may be appropriate to accept a cleanup criterion of 400-800 ppm, if we can be assured that the property will remain industrial.

As stated earlier, the above soil cleanup criteria do not consider potential impacts to groundwater. According to the 307 Rules, a soil concentration no greater than 20 times the health-based groundwater concentration is protective of the groundwater. However, a responsible party can utilize the direct contact soil equation or some value between the 20 times groundwater value and the direct contact value as a final cleanup goal if a leachate test demonstrates that the resulting leachate does not exceed the acceptable groundwater concentration. The groundwater concentration associated with an acceptable blood lead level of 5-10 ug/dl in children is 1-3 ppb. For adults, an acceptable groundwater concentration is 3-6 ppb. EPA has proposed an MCL of 5 ppb; a final MCL has not yet been established. An acceptable range of groundwater concentrations for lead is 1-6 ppb according to the method discussed above. A final Type B groundwater criterion of 5 ppb is recommended. This health-based value should be used unless it can be demonstrated that local background is higher, in which case, background will serve as the cleanup number.

In conclusion, several points warrant discussion and provide justification for a conservative approach in dealing with the cleanups of lead-contaminated sites. These points are: 1) lead has been classified as a probable human carcinogen and there is currently no established methodology to address this issue; 2) due to past and current exposures, the population in Michigan already has a certain blood lead level. A study conducted nationwide from 1976 to 1980 reported that the mean blood lead level for the entire U.S. population is 13 ug/dl. This suggests that further exposure to lead should be minimized as much as possible; 3) the threshold for noncarcinogenic effects of lead has not been identified and may be so low that essentially it may not exist; 4) the

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neurological effects associated with low blood lead levels may not be reversible; 5) significant exposure to lead occurs from the atmosphere.

As a summary, a soil cleanup criterion of background is recommended for residential areas. In industrial situations, where we can be assured that the property will remain industrial, it may be appropriate to accept a cleanup criterion of 400-800 ppm. The recommended groundwater cleanup criterion for dissolved lead is 5 ppb. If local background is greater, background will serve as the final cleanup goal.

Pleae contact Christine Flaga, MDNR, Environmental Response Division for further information. (517) 373-0160.

1/11/91cf

APPENDIX 1

RASMUSSEN ADMINISTRATIVE RECORD INDEX

Not incLuded

APPENDIX 2

RISK ASSESSMENT TABLES

RASMUSSEN CHEMICAL CONCENTRATIONS

BY AREA OF CONCERN

POOR QUALITY ORIGINAL

TABLE 2-5

CONTAMINANTS DETECTED IN GROUNDWATER
RASMUSSEN DUMP SITE

Contaminant	Residential Wells			Wells in Plume – Shallow			Background Wells – Shallow			Background Wells – Deep		
	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)
acetone	ND			110–26,000	6/14	2,630	ND			ND		
2-butanone	ND			22–74,000	5/14	6,630	46–60	2/59	2	11	1/9	1
2-hexanone	ND			3,000–3,100	2/14	435	ND			ND		
4-methyl-2-pentanone	ND			300–30,000	9/14	4,520	ND			ND		
benzene	ND			260–700	5/14	161	ND			ND		
ethylbenzene	ND			500–2,400	5/14	579	1	1/59	0.02	ND		
chlorobenzene	ND			1,000–3,700	5/14	914	5	1/59	0.08	ND		
toluene	ND			18,000–71,000	5/14	14,500	1–9	4/59	0.3	ND		
total xylenes	ND			3,700–11,000	5/14	2,690	2	1/59		ND		
1,1,1-trichloroethane	ND			99–500	5/14	82	ND			ND		
1,1-dichloroethane	ND			6–550	7/14	116	ND			ND		
tetrachloroethene	ND			2	1/14	0.1	2	2/59	0.07	ND		
trichloroethene	ND			8–500	5/14	54	2–774	9/59	20	ND		
1,2-dichloroethene	ND			240–590	4/14	114	ND			ND		
1,1-dichloroethene	ND			2	1/14	0.1	ND			ND		

TABLE 2-5
CONTAMINANTS DETECTED IN GROUNDWATER
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Residential Wells			Wells in Plume – Shallow			Background Wells – Shallow			Background Wells – Deep		
	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)
vinyl chloride	ND			96	1/14	7	ND			ND		
chloroform	ND			1–5	2/14	0.4	ND			ND		
methylene chloride	ND			100–1,100	3/14	96	5–10,000	8/59	340	ND		
trans-1,3-dichloro-propene	ND			34	1/14	2	ND			ND		
phenol	ND			17–62	5/14	10	3–12	5/59	0.6	8	1/9	0.9
2-methylphenol	ND			260–1,600	5/14	277	ND			ND		
4-methylphenol	ND			70–280	4/14	44	ND			ND		
2,4-dimethylphenol	ND			14–27	2/14	3	ND			ND		
2-chlorophenol	ND			12–17	2/14	2	ND			ND		
bis(2-ethylhexyl) phthalate	ND			12	1/14	0.9	3–24	4/59	0.8	2	1/9	0.2
di-n-butyl phthalate	ND			21	1/14	2	2–5	6/59	0.3	ND		
di-n-octyl phthalate	ND			ND			1–5	2/59	0.1	ND		
butyl benzyl phthalate	ND			ND			3–7	2/59	0.2	ND		
benzo(a)anthracene	ND			ND			3	2/59	0.1	ND		
chrysene	ND			ND			3	2/59	0.1	ND		
[illegible]-nitroaniline	ND			ND			2	1/59	0.03	ND		
4-nitroaniline	ND			ND			4	1/59	0.07	ND		

TABLE 2-5
CONTAMINANTS DETECTED IN GROUNDWATER
RASMUSSEN DUMP SITE
PAGE THREE

Contaminant	Residential Wells			Wells in Plume - Shallow			Background Wells - Shallow			Background Wells - Deep		
	Range of Positive Detections (µg/l)	No of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)	Range of Positive Detections (µg/l)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/l)
benzoic acid	ND			17	1/14	1	ND			51	1/9	6
benzyl alcohol	ND			12	1/14	0.9	2	1/59	0.03	ND		
isophorone	ND			91-440	3/14	60	ND			ND		
PCB-1260	ND			ND			12	1/59	0.2	ND		
dioxin	ND			ND*			ND**					
barium	ND			62-505	8/8	232	17-312	40/40	113	59-300	6/6	162
cadmium	ND			5-29	4/8	7	5-15	11/40	3	ND		
chromium	ND			7-195	5/8	48	4-112	26/40	26	7-8	2/6	2
copper	8-9	2/3	6	6-523	8/8	93	5-228	30/40	43	6-20	5/6	10
lead	ND			7-779	6/8	201	3-638	35/40	102	10-28	3/6	10
nickel	ND			7-343	7/8	72	7-133	25/40	28	7-10	3/6	4
zinc	48-950	3/3	353	1,070-80,800	8/8	30,600	180-213,200	40/40	16,600	375-2,430	6/6	1,230

NA = Not applicable
ND = Not detected

* One sample (RAD-GW-MW22) was collected in the plume area. Dioxin equivalents were 0.000.
** Three samples (RAD-GW-MW35; RAD-GW-MW27; RAD-GW-MW27D) were collected from the area south of the landfill. Dioxin equivalents were 0.000 in all samples.
Source: NUS Corporation, September 1988

POOR QUALITY ORIGINAL

TABLE 2-6

CONTAMINANTS DETECTED IN SOIL
TOP OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
acetone	30–300	3/6	57	32,000	1/16	2,000
2-butanone	30	1/6	5	120–100,000	2/16	6,260
4-methyl-2-pentanone	330	1/6	55			
benzene	6–11	2/6	3	6–7	3/16	1
ethylbenzene	17–1,600	5/6	458	6–160,000	4/16	10,100
chlorobenzene	6–980	5/6	259	100,000	1/16	625
toluene	8–1,700	6/6	363	6–300,000	4/16	18,800
total xylenes	77–5,300	5/6	1,900	12–2,700,000	3/16	169,000
styrene	48–590	2/6	106			
tetrachloroethene	10	1/6	2	5–1,400	4/16	88
trichloroethene	6–42	4/6	14	6–7	3/16	1
1,2-dichloroethene	6–8	2/6	2			
1,1,2-trichloroethane	42	1/6	7			
1,1,1-trichloroethane	9	1/6	2	7	1/16	0.4
1,1-dichloroethane	6	1/6	1			
chloroform	6	3/6	3	18	1/16	1
methylene chloride	96–450	5/6	181	111–10,000	4/16	701

TABLE 2-6
CONTAMINANTS DETECTED IN SOIL
TOP OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
phenol	500–2,300	3/6	550	620	1/16	39
4-methylphenol	500–1,700	3/6	633	1,400	1/16	88
pentachlorophenol	2,000	1/6	333	32,000	1/16	2,000
bis(2-ethylhexyl)phthalate	700–14,000	4/6	3,430	370–18,000,000	11/16	1,350,000
di-n-butyl phthalate	1,600–10,000	4/6	2,970	330–330,000	5/16	24,800
di-n-octyl phthalate	119–1,400	2/6	253	6,600	1/16	412
dimethyl phthalate				870–1,300	2/16	136
butyl benzyl phthalate	218	1/6	36	330–7,600,000	7/16	479,000
anthracene				580	1/16	36
benzo(a)pyrene	500	1/6	83			
fluoranthene				380–580	2/16	60
indeno(1,2,3-cd)pyrene	500	1/6	83			
naphthalene	9,300–13,000	2/6	3,720	330–150,000	4/16	9,490
2-methylnaphthalene	500–4,000	5/6	1,230	580–21,000	3/16	1,390
phenanthrene	500–1,000	4/6	417	580–6,600	2/16	449
pyrene				370–580	3/16	83

TABLE 2-6
CONTAMINANTS DETECTED IN SOIL
TOP OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE THREE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
N-nitrosodiphenylamine	500–3,000	2/6	583	370–18,000	6/16	1,330
benzoic acid	2,000	2/6	667			
isophorone	3,000	1/6	500	620–47,000	2/16	2,980
carbon disulfide	6–215	2/6	37	6–7	2/16	0.8
aniline				660	1/16	41
1,2-dichlorobenzene				380	1/16	24
1,4-dichlorobenzene				370–650	3/16	102
hexachlorobenzene				330	1/16	21
PCB-1242				3,600–4,800	4/21	800
PCB-1248				1,800–34,000	3/21	2,230
PCB-1254	160–61,000	33/34	16,500	200–62,000	12/21	5,980
PCB-1260				400–1,600	2/21	95
4,4'-DDT	330–870	2/34	35	210	1/16	13
endrin	270	1/34	8			
dioxin	0.002–0.024	8/10	0.007	+		

TABLE 2-6
CONTAMINANTS DETECTED IN SOIL
TOP OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE FOUR

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
barium	107–508	6/6	225	16–2,120	16/16	289
cadmium	2–14	2/6	3	2–39	7/16	5
chromium (total)	15–129	6/6	42	8–1,010	16/16	88
chromium (hexavalent)	+ +			+ +		
copper	9–19	6/6	14	13–554	16/16	97
lead	66–357	6/6	171	9–1,440	16/16	290
nickel	11–30	3/6	9	7–108	16/16	23
zinc	90–321	6/6	153	31–1,630	16/16	535

\+ Dioxin was not detected in sample RAD-SS-049.

\+ + Cr^{+6} was not detected in samples RA-SO-801 (waste); RA-SO-802; RA-SO-803.

* Includes sample numbers: RA-SO-13; RA-SO-14; RA-SO-19; RA-SO-19A; RA-SO-20; RA-SO-33; RA-SO-77; RA-SO-78; RA-SO-79; RA-SO-80, RA-SO-81, RA-SO-82, RA-SO-83; RA-SO-84; RA-SO-85; RA-SO-85A; RA-SO-86; RA-SO-87; RA-SO-88; RA-SO-89; RA-SO-90, RA-SO-91, RA-SO-92; RA-SO-93; RA-SO-94; RA-SO-95; RA-SO-96; RA-SO-108; RA-SO-109; RA-SO-110; RA-SO-111; RA-SO-112, RA-SO-117, RA-SO-117A, RA-SO-802; RA-SO-803; RAD-SO-009; RAD-SO-010; RAD-SO-011; RAD-SO-012; RAD-SO-013; RAD-SO-047; RAD-SO-047D; RAD-SO-048; RAD-SO-049; RAD-SO-050.

** Includes sample numbers: RA-TP-020; RA-TP-021; RA-TP-022; RA-TP-023; RA-TP-024; RA-TP-025; RA-TP-026; RA-TP-027; RA-TP-028, RA-TP-029, RA-TP-048; RA-TP-049; RA-TP-050; RA-TP-051; RA-TP-052; RA-TP-052A; RA-SO-097; RA-SO-098; RA-SO-099, RA-SO-100, RA-SO-101; RA-SO-801; RAD-SS-049.

Source: NUS Corporation, September 1988

TABLE 2-8

CONTAMINANTS DETECTED IN SOIL
SOUTH SLOPE OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE

Contaminant	Surface Soil*			Subsurface Soil**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
acetone	10	1/6	2			
2-hexanone	16	1/6	3			
benzene	2	1/6	0.3			
chlorobenzene	8	1/6	1			
ethylbenzene	26	1/6	4			
toluene	5-23	5/6	8			
total xylenes	42	1/6	7			
tetrachloroethene				19	1/4	5
trichloroethene	9	1/6	2			
methylene chloride	54-500	5/6	198			
chloroform	2-6	2/6	1			
bis(2-ethylhexyl)phthalate	334-3,920	5/6	1,460	4,660-11,700	2/4	4,090
di-n-butyl phthalate				290-794	4/4	535
di-n-octyl phthalate				708-761	2/4	367
butyl benzyl phthalate				86-204	2/4	72
acenaphthene				323	1/4	81
anthracene				1,142	1/4	286

TABLE 2-8
CONTAMINANTS DETECTED IN SOIL
SOUTH SLOPE OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Surface Soil*			Subsurface Soil**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
benzo(a)anthracene				1,200	1/4	300
benzo(b)fluoranthene				452	1/4	113
benzo(k)fluoranthene				813	1/4	203
benzo(a)pyrene				651	1/4	163
chrysene	500	1/6	83	1,200	1/4	300
fluoranthene				5,150	1/4	1,290
fluorene				438	1/4	110
naphthalene	500	1/6	83			
2-methylnaphthalene	500	1/6	83			
phenanthrene				4,090	1/4	1,020
pyrene				4,000	1/4	1,000
4-methylphenol	4,500	1/6	750			
2,4-dimethylphenol	500	1/6	83			
carbon disulfide	20-59	2/6	13	17-380	4/4	122
dibenzofuran				231	1/4	58
N-nitrosodiphenylamine	500	1/6	83			
PCB-1254	14,000	1/6	2,330	625	1/4	156
dioxin	0.001-2.996	9/9	0.48	0.003-0.349	7/7	0.11

TABLE 2-8
CONTAMINANTS DETECTED IN SOIL
SOUTH SLOPE OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE THREE

Contaminant	Surface Soil*			Subsurface Soil**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
barium	48–3,165	6/6	774	11–1,160	4/4	302
cadmium	5–21	4/6	6	15	1/4	4
chromium (total)	13–199	6/6	59	13–66	4/4	39
chromium (hexavalent)	+					
copper	16–244	6/6	69	6–567	4/4	149
lead	51–1,200	6/6	461	5–2,120	4/4	542
nickel	12–40	5/6	16	7–84	4/4	28
zinc	139–1,360	6/6	448	31–1,420	4/4	378

\+ Cr^{+6} was not detected in sample RA-SO-805.

* Includes sample numbers RA-SO-015; RA-SO-035; RA-SO-036; RA-SO-037; RA-SO-037A; RA-SO-066; RA-SO-805; RAD-SO-008; RAD-SO-023; RAD-SO-024; RAD-SO-025; RAD-SO-046; RAD-SO-053; RAD-SO-054; RAD-SO-055; RAD-SO-056.

** Includes sample numbers RA-SO-069; RA-SO-070; RA-SO-070A; RA-SO-071; RAD-SS-008; RAD-SS-023; RAD-SS-023D; RAD-SS-024; RAD-SS-025; RAD-SS-046; RAD-SS-054.

Source: NUS Corporation, September 1988

TABLE 2-9

CONTAMINANTS DETECTED IN SOIL
SOUTH BASE OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
acetone	15	1/2	8			
2-butanone	10	1/2	5			
ethylbenzene	13	1/2	6			
chlorobenzene	7	1/2	4			
toluene	5	1/2	2			
total xylenes	32	1/2	16			
trichloroethene	5	1/2	2	6	1/1	NA
chloroform	5	1/2	2			
methylene chloride	150	1/2	75			
pentachlorophenol				3,300	1/1	NA
bis(2-ethylhexyl)phthalate				6,900	1/1	NA
naphthalene	500	1/2	250			
2-methylnaphthalene	500	1/2	250			
pyrene	500	1/2	250			
N-nitrosodiphenylamine				370	1/1	NA
benzoic acid	2,000	1/2	1,000			
PCB-1254	9,900	1/2	4,950	470	1/1	NA
PCB-1260				180	1/1	NA
dioxin	0.002-0.089	3/3	0.032	++		

TABLE 2-9
CONTAMINANTS DETECTED IN SOIL
SOUTH BASE OF MUNICIPAL LANDFILL
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
barium	140–1,030	2/2	585	175	1/1	NA
cadmium	4	1/2	2			
chromium (total)	33–89	2/2	61	25	1/1	NA
chromium (hexavalent)	+					
copper	43	1/2	22	55	1/1	NA
lead	188–835	2/2	512	325	1/1	NA
nickel	19	1/2	10	13	1/1	NA
zinc	94–642	2/2	368	153	1/1	NA

NA Not applicable
* Includes sample numbers RA-SO-004; RA-SO-016; RA-SO-804; RAD-SO-026; RAD-SO-027; RAD-SO-052.
** Includes sample numbers RA-TP-053; RAD-SS-052; RAD-SS-052D.
\+ Cr^{+6} was not detected when analyzed in sample RA-SO-804.
\+ + Dioxin was not detected in samples RAD-SS-052; RAD-SS-052D.
Source: NUS Corporation, September 1988

TABLE 2-14

CONTAMINANTS DETECTED IN SOIL AND WASTE *
NORTHEAST BURIED DRUM AREA
RASMUSSEN DUMP SITE

Contaminant	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)
acetone	28–4,000,000	18/18	613,000
2-butanone	4,800–66,000,000	11/18	2,100,000
4-methyl-2-pentanone	12,000–16,000,000	8/18	1,380,000
2-hexanone	410,000–680,000	2/18	60,600
benzene	54,000	1/18	3,000
ethylbenzene	5–21,000,000	15/18	1,850,000
chlorobenzene	15–2,600,000	15/18	429,000
toluene	5–30,000,000	15/18	3,980,000
total xylenes	22–17,000,000	16/18	4,780,000
styrene	5,000–40,000,000	3/18	2,280,000
tetrachloroethene	5–54,000	3/18	3,000
trichloroethene	11–340,000	6/18	30,900
1,1,1-trichloroethane	6–850,000	5/18	53,900
1,1-dichloroethane	12–100,000	2/18	5,560
methylene chloride	10,000–500,000	10/18	76,500
phenol	45,000	1/18	2,500
bis(2-ethylhexyl)phthalate	330–210,000	11/18	25,700
di-n-butyl phthalate	330–190,000	13/18	23,100
di-n-octyl phthalate	6,600–17,000	2/18	1,310
butyl benzyl phthalate	330–530,000	12/18	62,900
fluorene	710,000	1/18	39,400
naphthalene	660–1,300,000	14/18	140,000
2-methylnaphthalene	6,600–460,000	10/18	40,900
phenanthrene	6,600–2,900,000	9/18	181,000
isophorone	20,000–100,000	3/18	7,830

TABLE 2-14
CONTAMINANTS DETECTED IN SOIL AND WASTE *
NORTHEAST BURIED DRUM AREA
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)
PCB-1254	160–22,000,000	18/18	2,570,000
PCB-1260	8,400–32,000	2/18	2,240
4,4'-DDT	520	1/18	29
dioxin**	0.012–0.061	4/5	0.027
	(mg/kg)		(mg/kg)
barium	10–10,100	18/18	1,660
cadmium	2–9	10/18	3
chromium	11–798	17/18	219
copper	5–70	18/18	33
lead	10–5,170	18/18	1,470
nickel	3–39	18/18	17
zinc	45–8,210	18/18	1,580

* Includes sample numbers RA-TP-030; RA-TP-031; RA-TP-032; RA-TP-033; RA-TP-034; RA-TP-035; RA-TP-036; RA-TP-037; RA-TP-038; RA-TP-039; RA-TP-040; RA-TP-041; RA-TP-042; RA-TP-043; RA-TP-044; RA-TP-045; RA-TP-046; RA-TP-047; RAD-SO-014; RAD-SO-015; RAD-SO-016; RAD-SS-015; RAD-SS-016.

** Dioxin was analyzed in both surface and subsurface soil samples.
Source: NUS Corporation, September 1988

TABLE 2-15

CONTAMINANTS DETECTED IN SOIL
INDUSTRIAL WASTE AREA
RASMUSSEN DUMP SITE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
acetone	25	1/3	8			
2-butanone				86,000	1/11	7,820
4-methyl-2-pentanone				240,000	1/11	21,800
benzene	6	1/3	2			
ethylbenzene				160,000–300,000	2/11	41,800
chlorobenzene				9–150,000	3/11	23,600
toluene	2–6	2/3	3	4–1,500,000	6/11	163,000
total xylenes	6	1/3	2	5–1,700,000	3/11	224,000
styrene				50,000	1/11	4,540
tetrachloroethene				7–12	2/11	2
trichloroethene	6	1/3	2	9	1/11	0.8
1,1,1-trichloroethane				10	1/11	0.9
chloroform	1	1/3	0.3			
methylene chloride	98-130	2/3	76	29–99	7/11	59
carbon disulfide				44	1/11	4
dichlorodifluoromethane				10–110	8/11	34
pentachlorophenol				3,978	1/11	361

TABLE 2-15
CONTAMINANTS DETECTED IN SOIL
INDUSTRIAL WASTE AREA
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
bis(2-ethylhexyl)phthalate	1,400	1/3	467	137–24,000	4/11	2,470
di-n-butyl phthalate				330–6,600	3/11	667
di-n-octyl phthalate	500	1/3	167			
butyl benzyl phthalate				8,900–110,000	2/11	10,800
acenaphthylene				3,499	1/11	318
benzo(a)anthracene				1,043	1/11	95
benzo(b)fluoranthene				1,159	1/11	105
benzo(k)fluoranthene				1,159	1/11	105
benzo(a)pyrene				759	1/11	69
fluoranthene				1,043	1/11	95
naphthalene				32,000–35,000	2/11	6,090
2-methylnaphthalene				3,100–7,000	2/11	918
phenanthrene				148–6,600	2/11	613
pyrene				1,033	1/11	94
N-nitrosodiphenylamine				13,000	1/11	1,180
aniline				566	1/11	51
PCB 1254	260–2,300	2/3	853	5,200–4,800,000	2/11	437,000
dioxin	†					

TABLE 2-15
CONTAMINANTS DETECTED IN SOIL
INDUSTRIAL WASTE PIT
RASMUSSEN DUMP SITE
PAGE THREE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detection/ No. of Samples	Average Concentration
	(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
barium	22	1/3	7	8–35,000	9/11	3,720
cadmium	5	1/3	2	2–546	3/11	50
chromium (total)	7	1/3	2	4–11,300	11/11	1,040
copper	33	1/3	11	6–7,340	11/11	679
lead	4–10	3/3	7	3–132,000	11/11	12,000
nickel	10–20	2/3	10	6–3,800	11/11	356
zinc	25–421	3/3	157	15–280,000	10/11	25,800

* Includes sample numbers RA-SO-17; RA-SO-21; RA-SO-65; RAD-SO-018.
**Includes sample numbers RA-SO-49; RA-SO-50; RA-TP-011; RA-TP-012; RA-TP-013; RA-TP-014; RA-TP-015; RA-TP-016; RA-TP-017; RA-TP-018; RA-TP-019.
† Dioxin was not detected in sample RAD-SO-018.
Source: NUS Corporation, September 1988

TABLE 2-16

CONTAMINANTS DETECTED IN SOIL
PROBABLE DRUM STORAGE/LEAKAGE/DISPOSAL AREA (AFTER EXCAVATION)
RASMUSSEN DUMP SITE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
acetone				45–6,950	2/10	700
2-butanone	12	1/16	0.8	49,063	1/10	4,910
4-methyl-2-pentanene				2,822	1/10	282
ethylbenzene	7,900–53,000	3/16	15,100	25–261	4/10	36
chlorobenzene	6,000–38,000	2/16	2,750	65–344	4/10	61
toluene	2–190,000	12/16	12,700	43–248	4/10	57
total xylenes	6–360,000	4/16	27,900	59–2,655	4/10	298
styrene				6	1/10	0.6
tetrachloroethene	5–10	2/16	0.9	5–7	2/10	1
1,1,1-trichloroethane	11	1/16	0.7	16–864	3/10	91
methylene chloride	35–105	3/16	12	18–36	4/10	10
carbon disulfide				65–124	2/10	19

TABLE 2-16
CONTAMINANTS DETECTED IN SOIL
PROBABLE DRUM STORAGE/LEAKAGE/DISPOSAL AREA (AFTER EXCAVATION)
RASMUSSEN DUMP SITE
PAGE TWO

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration	Range of Positive Detections	No. of Positive Detections/ No. of Samples	Average Concentration
	(µg/kg)		(µg/kg)	(µg/kg)		(µg/kg)
bis(2-ethylhexyl)phthalate	368–1,552	5/16	280	370–800	2/10	117
di-n-butyl phthalate	42–22,000	6/16	1,900	48–330	2/10	38
di-n-octyl phthalate	82	1/16	5			
diethyl phthalate	58–130	2/16	12	56–180	4/10	46
butyl benzyl phthalate	72–30,000	5/16	2,886	176	1/10	18
naphthalene	52–100,000	4/16	7,650			
2-methylnaphthalene	70–31,000	4/16	2,570			
phenanthrene	65–7,500	4/16	616			
N-nitrosodiphenylamine	40–24,000	6/16	1,910	117	1/10	12
benzoic acid	36,000	1/16	2,250			
PCB-1254	310–16,000	6/16	1,740	607	1/10	61
dioxin	0.008–0.019	2/4	0.007			

TABLE 2-16
CONTAMINANTS DETECTED IN SOIL
PROBABLE DRUM STORAGE/LEAKAGE/DISPOSAL AREA (AFTER EXCAVATION)
RASMUSSEN DUMP SITE
PAGE THREE

Contaminant	Surface Soil*			Subsurface Soil/Waste**		
	Range of Positive Detections (µg/kg)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/kg)	Range of Positive Detections (µg/kg)	No. of Positive Detections/ No. of Samples	Average Concentration (µg/kg)
	(mg/kg)		(mg/kg)	(mg/kg)		(mg/kg)
barium	11–37	3/7	20	7–21	10/10	11
chromium	7–13	3/3	10	3–10	10/10	6
copper	10–12	3/3	11	6–17	10/10	9
lead	4–14	3/3	8	3–7	8/10	3
nickel	8–12	3/3	10	6–12	8/10	6
zinc	27–43	3/3	33	18–38	10/10	27

* Includes sample numbers RA-SO-40; RA-SO-118; RA-SO-119; RA-SO-120; RA-SO-121; RA-SO-122; RA-SO-123; RA-SO-124; RA-SO-125; RA-SO-125A; RA-SO-126; RA-SO-128; RA-SO-130; RA-SO-132; RA-SO-134; RA-SO-135; RAD-SO-019; RAD-SO-020; RAD-SO-021; RAD-SO-022.

** Includes sample numbers RA-SO-43; RA-SO-44; RA-SO-45; RA-SO-51; RA-SO-72; RA-SO-073; RA-SO-127; RA-SO-127A; RA-SO-129; RA-SO-131; RA-SO-133;.

Table 2-16 does not include 2 sample locations (RA-SO-38 and RA-SO-39) that were destroyed by excavation activities in June 1987.

Source: NUS Corporation, September 1988

APPENDIX 3

1989/1990 TECHNICAL MEMORANDUM

SUPPLEMENTAL SOILS INVESTIGATION - PDSLD

MICHIGAN DEPARTMENT OF NATURAL RESOURCES

INTEROFFICE COMMUNICATION

March 26, 1990

TO: Rasmussen Site File

FROM: Jim Myers, SMU 2, Superfund Section

SUBJECT: Technical Memo Rasmussen Dump Site Excavation Area Soil Investigation

Attached is the summary of the field activities at the Rasmussen site from December 14, 1989 to January 9, 1990. Included in this report are results and conclusions from the above activities.

cc: Ms. Denise Gruben
Ms. Claudia Kerbawy
Mr. Ray Milejczak

Jim Myers

R 1030

TECHNICAL MEMORANDUM
RASMUSSEN DUMP SITE EXCAVATION AREA
SOIL INVESTIGATION
DECEMBER 14, 1989 - JANUARY 9, 1990

ENVIRONMENTAL RESPONSE DIVISION
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
STATE OF MICHIGAN

MARCH 1990

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SECTION I

INTRODUCTION

The Rasmussen site is located in Green Oak Township, Livingston County, Michigan. Between 1984 and 1989 the Michigan Department of Natural Resources (MDNR) and the U.S. Environmental Protection Agency (EPA) conducted a Remedial Investigation and Feasibility Study (RI/FS) in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In June, 1987,approximately 7,000 cubic yards of soil were excavated for use as residental and commercial construction materials off-site. This soil was returned to the Rasmussen site (November, 1987 thru July, 1988) under court order.

The initial RI soil sampling (1984) in and near the excavation indicate that high levels of volatile organic hydrocarbons (VOC's) and PCB's exist directly adjacent to the excavation. Analysis of groundwater samples collected from existing monitoring wells on site indicated groundwater contamination directly beneath the excavated area.

Contaminants found in the soil and groundwater in the vicinity of the excavation included the following:

	Maximum Concentration	
Compound	Soil(mg/Kg)	Groundwater(mg/L)
toluene	71.0	290
xylene	9.1	760
ethylbenzene	2.4	160
chlorobenzene	3.7	110
2-butanone	74.0	-
PCB's	5.2	-
napthalene	35.0	-

Further sampling of this area, now reffered to as the "Ramsey Excavation", was conducted by Warzyn Engineering Inc. (Warzyn) in July, 1987. This included sampling of surface and subsurface soils in and near the excavated area. Analyses of these samples consisted of VOC's, acid/base neutral fraction, and pesticide/PCB fraction. The results of this phase of sampling and analysis identified the excavation as part of an area where drums were once stored, and possibly leaked contaminants to the soil. The excavation and vicinity was renamed the Probable Drum Storage/Leakage/Disposal (PDSLD) area.

In order to further define the extent of the PDSLD, additional sampling was conducted by NUS in the excavation area and several areas throughout the Speigelberg/Rasmussen properties. This included surface and subsurface soil sampling, with field screening for selected organics (Table 1.), by NUS, and laboratory analysis for PCB's (Table 2.), by W.W. Engineering and Science (W.W.).

Table 1. Target Organic compounds for Field Screening.

Organic Analyses
1,2-Dichlorobenzene
Chloroform
1,1-Dichloroethane
1,3-Dichlorobenzene
1,1-Dichloroethene
trans-1,2-Dichloroethene
Methylene chloride
Tetrachloroethene
1,1,1-Trichloroethane
Trichloroethene
Benzene
Chlorobenzene
Ethylbenzene
Toluene
Xylenes*

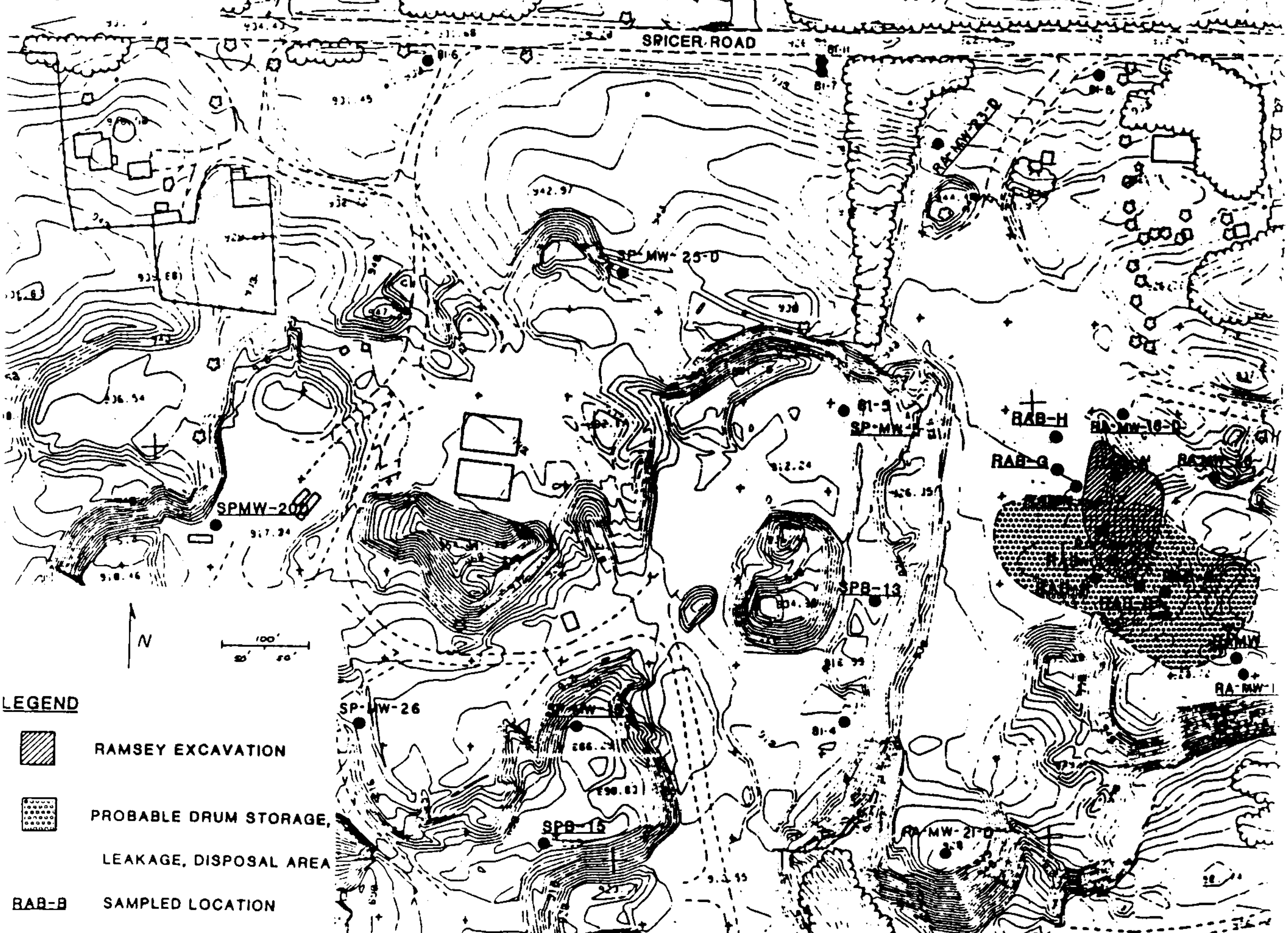
* The ortho, meta, and para isomers of xylene will be resolved individually to the degree allowed by the instrument detector, and chromatographic column used.

Table 2.
Target PCB Compounds

PCB Analyses
1016
1221
1232
1242
1248
1254
1260

This Technical Memorandum summarizes the PDSLD area investigation, which was conducted from December 14, 1989 to January 9, 1990. The memorandum documents all site activities conducted by NUS, and reports all analytical results from this study. All previous sampling efforts and reports have been considered in the conclusions regarding the nature and extent of the contaminants in the PDSLD.

Figure 1. S[illegible] Map



Prior to sampling for Selected Organic Field Sceening, all sampling equipment was decontaminated using liquinox in potable water, followed by a distilled water rinse. Between samples, all sampling spatulas were decontaminated using procedure documented above, followed by a distilled water rinse. Excess water was then shaken from the equipment and allowed to air dry. When necessary, clean paper towelling was used to dry implements.

Disposable wooden spatulas were used for all PCB sampling. These spatulas were disposed of after one use.

Selected Organics Sampling and Field Screening

Selected organics field screning samples were collected in a 200 mL, wide mouth glass jar. Soil was sampled from the length of the split barrel sampler. Samples were analyzed daily by gas chromatography in a mobile lab located at the VFW Hall, near the site. The method of analysis and quality assurance and quality control procedures are documented in the work plan (see appendix 2.). Validation of this data was performed by NUS.

PCB Sampling and Analysis

Samples were collected from the length of the split barrel sampler in a 250 mL glass jar and stored in iced coolers until further processing. Twice daily, sample jars were sealed with a custody seal, logged in on a Chain of Custody Record, sealed in a plastic bag, and placed in a cooler on ice, which was in turn sealed with a custody seal, until delivery to W.W. Engineering and Science within 7 days. All PCB samples were analyzed according to EPA method 8080. Validation of this data was performed by W.W. Engineering and Science.

SECTION III

FIELD ACTIVITIES

Field activities were performed at the site from December 14, 1989 thru January 10, 1990. Soil, VOC, and PCB sampling was performed during this period.

The following personnel were present at the site on the dates given:

MDNR:	
Denise Gruben	12/14/89 - 1/2/90, & 1/10/90
Ray Milejczak	12/14/89 - 12/21/89 & 1/8/90
Jim Myers	12/26/89 - 1/9/90
NUS:	
Dan Hamel	12/14/89 - 1/10/90
Roy Conley	12/14/89 - 1/5/90
Tim Mayotte	1/5/90 & 1/8/90
Stearns Drilling Co.:	
Kelly Ruhlman	12/14/89 - 12/21/89
Gary Geerligs	12/14/89 - 12/21/89
Duane Daverman	12/26/89 - 1/10/90
Darryl Krause	12/26/89 - 12/28/89
Jim Gryska	1/2/90 - 1/10/90

The following outline documents daily activities on the site.
All sample depths subject to lithologic confirmation.
<u>Underlined</u> samples indicate PCB analysis
* indicates selected organics field screening

Date	Location	Sample Depth (ft. below grade)/Parameters
12/14/89	SPMW-5D	4.5-6, 14.5-16, 19.5-21, 24.5-26, 29.5-31, 34.5-36
12/14/89	SPB-13	0-0.7, 2.5-4.0, 5.0-5.6, 8.5-10.0
12/15/89	RAB-I	<u>0-1.0*</u>, 1.5-3, <u>3-4.5*</u>, 4.5-6, <u>6-7.5*</u>, 7.5-9, <u>9-10.5*</u>, 10.5-12, <u>12-13.5*</u>, 13.5-15, <u>15-16.5*</u>, 16.5-18, <u>18-19.5*</u>, <u>19.5-21*</u>, <u>25-26.5*</u>, <u>30-31.5*</u>, <u>35-36.5*</u>, <u>40-41.5*</u>, 41.5-43, <u>43-44.5*</u>, 44.5-46
12/18/89	RAB-F	<u>0-1.5*</u>, 1.5-3, <u>3-4.5*</u>, 4.5-6, <u>6-7.5*</u>, 7.5-9, <u>9-10.5*</u>, 10.5-12, <u>12-13.5*</u>, 13.5-15, <u>15-16.5*</u>, 16.5-18, <u>18-19.5*</u>, <u>19.5-21*</u>, <u>25-26.5*</u>, <u>30-31.5*</u>, <u>35-36.5*</u>, <u>40-41.5*</u>, 41.5-43, <u>43-44.5*</u>, 44.5-46, <u>46-47.5*</u>, 47.5-49, <u>49-50.5*</u>, 50.5-52, <u>52-53.5*</u>, 53.5-55, <u>55-56.6*</u>, <u>58-59.5*</u>

12/19/89	RAB-E	0-1.5, 1.5-3, 3-4.5, 4.5-6, 6-7.5, 7.5-9, 9-10.5, 10.5-12, 12-13.5, 13.5-15, 15-16.5, 16.5-18, 18-19.5, 19.5-21, 21-22.5, 25.5-27, 27-28.5, 28.5-30, 30-31.5, 31.5-33, 33-33.85
12/20/90	RAMW28D	3.5-5, 8.5-10, 13.5-15, 18.5-20, 23.5-25, 28.5-30, 33.5-35, 38.5-40, 43.5-45
12/20-21/89	RAMW17	3.5-5.0, 8.5-10, 13-15, 18.5-20, 23.5-25, 28.5-30, 33.5-35, 38.5-40
12/26/89	RAB-G	0-0.75, 1.5-3, 3-4.5, 4.5-6, 6-7.5, 7.5-9, 9-10.5, 10.5-12, 12-13.5, 13.5-15, 15-16.5, 16.5-18, 18-19.5, 19.5-21, 24.5-26, 29.5-31, 34.5-36, 39.5-41, 41-42.5, 42.5-44, 44-45.5, 45.5-47, 46-48.5, 49-50.5, 50-51.5, 54.5-56
12/27/89	RAB-H	0-1.5, 1.5-3, 3-4.5, 4.5-6, 6-7.5, 7.5-9, 9-10.5, 10.5-12, 12-13.5, 13.5-15, 15-16.5, 16.5-18, 18-19.5, 19.5-21, 24.5-26, 29.5-31, 34.5-36, 39.5-41, 41-42.5, 42.5-44, 44-45.5, 45.5-47, 47-48.5, 48.5-50, 50-51.5, 51.5-53, 54.5-56
1/2/90	RAB-A	<u>0-1.5*</u>, 2-4, <u>4-5*</u>, <u>5-6*</u>, <u>6-8*</u>, <u>8-10*</u>, <u>10-12*</u>, <u>12-14*</u>, 14-16, <u>33-35*</u>
1/3/90	RAB-C	<u>0-2*</u>, 2-4, 4-6, <u>6-8*</u>, 8-10, 10-12, <u>12-14*</u>, <u>14-16*</u>, 17-19, <u>18-20*</u>, 20-22, 22-24, <u>24-26*</u>, 27-28, 28-30, <u>30-32*</u>, 32-34, 34-36, <u>35-37*</u>
1/3-4/90	RAB-D	<u>0-1.5*</u>, 1.5-3, <u>3-4.5*</u>, 4.5-6, <u>6-7.5*</u>, 7.5-9, <u>9-10.5*</u>, 10.5-12, <u>12-13.5*</u>, 13.5-15, <u>15-16.5*</u>, 16.5-18, <u>18-19.5*</u>, <u>19.5-21*</u>, <u>25-26.5*</u>, <u>30-31.5*</u>, <u>35-36.5*</u>, <u>40-41.5*</u>, 41.5-43, <u>43-44.5*</u>, 44.5-46, <u>46-47.5*</u>, 47.5-49, <u>49-50.5*</u>, 50.5-52, <u>52-53.5*</u>, <u>53.5-55*</u>
1/4-5/90	RAMW18D	<u>19-21*</u>, <u>24-26*</u>, 29.5-31, 34-36, 44-45.5, 49-50.5, 54-55.5
1/8/90	SPMW20D	4.5-6, 9-11, 14-16, 19-21, 24-26, 29-31, 34-36, 39-41, 44-46, 49-51
1/8/90	SPMW15	4-6, 6-8, 9-11, 14-16, 19-21, 24-26, 29-31
1/9/90	SPB15	0-1.5, 1.5-3, 3-4.5, 4.5-6, 6-7.5, 7.5-9, 9-10.5, 10.5-12, 12-13.5, 14-15.5, 19-20.5, 24-25.5, 29-31.5*

1/9/90	RAMW-23D	0-1.5, 1.5-3, 3-4.5, 4.5-6, 6-7.5, 7.5-9, 9-10.5, 10.5-12, 12-13.5, 13.5-15, 15-16.5, 16.5-18, 18-19.5, 19.5-21, 21-22.5, 22.5-24, 24-25.5, 25.5-27, 27-28.5, 28.5-30, 34-36.5, 39-40.5, 44-45.5, 49-50.5, 54-55

SECTION IV

RESULTS

Results of the soil sampling and chemical analyses are presented in the following tables and appendicies. This includes HNu readings, boring logs, selected organics field screening, PCB analysis.

HNu readings taken in the field at the the time of sample collection are listed in Appendix 1.

Due to the fact that some of this work was done to replace previously completed work, only boring logs for new borings and and those replacement borings that differed significantly from the original boring logs were supplied by NUS. Boring logs for all locations, either original or new, are attached (Appendix 3).

The analytical results of the PCB analysis were supplied by W.W. PCBs were detected in five samples. These five samples were also analyzed under the contract laboratory program (CLP) criteria. Table 3 is a listing of the results of the initial PCB analysis and the CLP criteria analysis for those samples where PCB's were detected. The results of all PCB analysis are included in Appendicies 4 and 5.

Table 3. PCB Measurements in Soils

Sample location (depth)	Initial Analysis Conc. (ppb)	CLP Analysis Conc. (ppb)
RAB-C (0-2)'	160	180
RAB-D (0-1.5')	1,200	1,000
RAB-F (0-1.5')	200	280
RAB-F (3.0-4.5')	200	170
RAB-I (1.5')	180	190

The analytical results of the selected organics field screening were supplied by NUS. Raw data sheets, GC retention time displays, and quality control reports are included in Appendix 6. Copies of these documents are maintained in NUS and MDNR files and have been supplied to the potentially responsible party's designated representative. Table 4 is a listing of the analytical results of the selected organics field screening of samples from the Spiegelberg and Rasmussen sites.

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAB-A

Depths (ft)	0-2	2-4	4-6	6-8	8-10	10-12	12-14	33-35
Methylene Chloride	2U	2U	2U	2U	2U	2U	2U	2U
1,1-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1U	1U	1U	1U	1U	1U	1U	3.3
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U
Chloroform	2U	2U	2U	2U	2U	2U	2U	2U
1,1,1-Trichloroethane	1.7	2.0	6.2	2.4	1U	2.0	10P	8.2
Trichloroethene	1U	1U	1.8	1U	1U	1U	2.0	3.6
Benzene	1U	1U	1U	1U	1U	1U	1U	2.0
Tetrachloroethene	1U	1U	1U	1U	1U	1U	1U	1U
Toluene	1.4	1.4	2.8	1.6	1.8	1.6	1.6	2.2
Chlorobenzene	1.3	1.4	1.3	1.2	1.3	1U	1U	5.6
Ethylbenzene	3.4	1.7	1.8	1U	1.4	1U	1U	1U
o-Xylene	1.9	1.7	1.8	1.6	1.7	1.6	1.4	1.8
m,p-Xylenes	1.8	1.8	1.7	1.4	1.4	1.3	1.3	1.5
1,3-Dichlorobenzene	2.0	2U	2U	2U	2U	2U	2U	2U
1,2-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAB-C

Depths (ft)	0-2	6-8	6-8 (dup)	12-14	14-16	18-20	24-26	30-32	35-37
Methylene Chloride	2U	2U	2U	2U	250U	125U	500U	250U	500U
1,1-Dichloroethene	1U	1U	1U	1U	125U	62U	250U	125U	250U
1,1-Dichloroethane	1U	1U	1U	1U	125U	62U	250U	125U	250U
trans-1,2-Dichloroethene	1U	1U	1U	1U	125U	62U	250U	125U	250U
Chloroform	2U	2U	2U	2U	250U	125U	500U	250U	500U
1,1,1-Trichloroethane	2.0	1U	2.4	6.1	110	62U	250U	125U	250U
Trichloroethene	1U	1U	1U	1U	125U	62U	250U	125U	250U
Benzene	1U	1U	1U	1U	125U	62U	250U	125U	250U
Tetrachloroethene	3.7	8.5	6.4	1U	250	62U	500	450.	250U
Toluene	1.7	1.4	1.5	5.0B	360B	83B	2900B	1400	420B
Chlorobenzene	1U	1U	1U	94	2200	620	4800	3000	1400
Ethylbenzene	1.4	1U	1U	37	1300P	500P	3600	1900	1800
o-Xylene	1.8	1.4	1.4	140	4200	1400	9200	4800	2800
m,p-Xylenes	1.4	1.2	1.2	110	3000	1000	6800	3500	1900
1,3-Dichlorobenzene	2U	2U	2U	2U	250U	125U	500U	250U	500U
1,2-Dichlorobenzene	2U	2U	2U	2U	250U	125U	500U	250U	500U

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAB-D

Depths (ft)	0-1.5	3-4.5	6-7.5	9-10.5	12-13.5	12-13.5 (dup)	15-16.5	18-19.5	19.5-21	25-26.5	30-31.5	35-36.5
Methylene Chloride	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,1-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	2U	2U
1,1-Dichloroethane	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1.5	1U	1.7	1.6	1U
Chloroform	2U	2U	2U	2U	2U	2U	1U	1U	1U	1U	1U	1U
1,1,1-Trichloroethane	1U	1U	1U	1U	2U	2U	2U	2U	2U	2U	2U	2U
Trichloroethene	1U	1U	1U	1U	16	16	3.2	32	31	27	24P	1U
Benzene	1U	1U	1U	4.1	2.8	3.4	2.1	5.4	4.8	3.0	1U	1U
Tetrachloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Toluene	2.4	7.2	14	47	23	26	17	51	44	23	9.4	1U
Chlorobenzene	2.78	5.08	5.18	4.2	3.8	2.4	5.8	5.5	3.9	4.6	22	2.5
Ethylbenzene	3.0	3.9	3.4	2.7	2.3	1U	2.4	3.3	2.9	1.8	9.9	3.6
o-Xylene	1.9	2.9	2.4	1U	1.5	1U	2.0	1U	1U	1.5	6.3	1U
m,p-Xylenes	4.3	4.0	3.0	4.2	1.8	1.6	2.8	3.3	2.5	2.0	19	5.8
1,3-Dichlorobenzene	3.4	3.1	2.4	2.9	1.7	1.6	2.1	2.3	1.7	1.6	13	3.5
1,2-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	4.2

Depths (ft)	40-41.5	43-44.5	46-47.5	49-50.5	49-50.5 (dup)	52-53.5	53.5-55	53.5-55 (dup)
Methylene Chloride	2U	250U	250U	250U	250U	250U	250U	250U
1,1-Dichloroethene	1U	125U	125U	125U	125U	125U	125U	125U
1,1-Dichloroethane	2.6	125U	125U	125U	125U	125U	125U	125U
trans-1,2-Dichloroethene	1U	125U	125U	125U	125U	125U	125U	125U
Chloroform	2U	250U	250U	250U	250U	250U	250U	250U
1,1,1-Trichloroethane	29	125U	125U	125U	125U	125U	125U	125U
Trichloroethene	1U	125U	125U	125U	125U	125U	125U	125U
Benzene	1U	125U	125U	125U	125U	125U	125U	125U
Tetrachloroethene	6.8	120	120	110	120	125U	200	190
Toluene	14	1300	1800	720	2200	2000	1100	1000
Chlorobenzene	26	1400	1400	870	1800	1800	840	940
Ethylbenzene	15	960	710	820	1400	820	650	600
o-Xylene	61	2900	2900	1900	3600	3200	1800	1900
m,p-Xylenes	51	2200	2100	1500	2700	2500	1400	1500
1,3-Dichlorobenzene	2U	440	250U	250U	250U	250U	250U	250U
1,2-Dichlorobenzene	2U	250U	250U	250U	250U	250U	250U	250U

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAB-F

Depths (ft)	0-1.5	3-4.5	6-7.5	9-10.5	12-13.5	15-16.5	18-19.5	18-19.5 (dup)	19.5-21	25-26.5	30-31.5	35-36.5
Methylene Chloride	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,1-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Chloroform	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,1,1-Trichloroethane	1U	1.8	1.9	2.0	4.1	10	12	11	5.8	6.5	5.4	7.4
Trichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Benzene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Tetrachloroethene	3.0J	27	35J	66J	130J	150J	99J	100J	89J	67J	45J	25J
Toluene	1.4	1U	1.4	1U	2.0	2.1	1U	1.0	2.3	2.5	1.1	1U
Chlorobenzene	1U	1U	1U	1U	1U	1U	1U	1U	1.0J	1U	1U	1U
Ethylbenzene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
o-Xylene	1U	1U	1U	1U	1U	1U	1U	1U	1.3	1.2	1U	1U
m,p-Xylenes	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,3-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,2-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U

Depths (ft)	40-41.5	40-41.5 (dup)	43-44.5	46-47.5	49-50.5	52-53.5	55-56.5	58-59.5
Methylene Chloride	2U	2U	2U	2U	2U	2U	250U	125U
1,1-Dichloroethene	1U	1U	1U	1U	1U	1U	125U	62U
1,1-Dichloroethane	1U	1U	1U	1U	1U	1U	125U	62U
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U	1U	125U	62U
Chloroform	2U	2U	2U	2U	2U	2U	250U	125U
1,1,1-Trichloroethane	1.1	1.4	1U	4.0	2.3	2.2	125U	62U
Trichloroethene	1U	1U	1U	1U	1U	1U	125U	62U
Benzene	1U	1U	1U	1U	1U	1U	125U	62U
Tetrachloroethene	1.2	1.8	1U	2.8J	2.2J	1U	125U	62U
Toluene	1U	1U	1U	1U	1.8	6.3	1300	62U
Chlorobenzene	1U	1U	1U	1U	1U	3.1J	970	760
Ethylbenzene	1U	1U	1U	1U	1.2J	2.5J	680	580
o-Xylene	1U	1U	1U	1U	2.8	5.9	2000	1600
m,p-Xylenes	1U	1U	1U	1U	1.7	3.7	1500	1200
1,3-Dichlorobenzene	2U	2U	2U	2U	2U	2U	250U	125U
1,2-Dichlorobenzene	2U	2U	2U	2U	2U	2U	250U	125U

Table 4.

ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAB-I

Depths (ft)	0-1.5	3-4.5	6-7.5	9-10.5	12-13.5	15-16.5	18-19.5	19.5-21	25-26.5	30-31.5	30-31.5 (dup)	35-36.5
Methylene Chloride	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,1-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,1-Dichloroethane	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Chloroform	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,1,1-Trichloroethane	1U	1.2	1.4	1.6	4.9	2.2	1.1	1U	1.2	1U	1U	1U
Trichloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Benzene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Tetrachloroethene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Toluene	1U	1U	1U	1U	1U	1.6	1U	1U	1U	1U	1U	1U
Chlorobenzene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
Ethylbenzene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
o-Xylene	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
m,p-Xylenes	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U	1U
1,3-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U
1,2-Dichlorobenzene	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U	2U

Depths (ft)	40-41.5	43-44.5
Methylene Chloride	2U	2U
1,1-Dichloroethene	1U	1U
1,1-Dichloroethane	1U	1U
trans-1,2-Dichloroethene	1U	1U
Chloroform	2U	2U
1,1,1-Trichloroethane	1U	1.2
Trichloroethene	1U	1U
Benzene	1U	1U
Tetrachloroethene	1U	1.3J
Toluene	1U	2.9
Chlorobenzene	1.7	12J
Ethylbenzene	1U	1U
o-Xylene	1U	1U
m,p-Xylenes	1U	1.0
1,3-Dichlorobenzene	2U	2U
1,2-Dichlorobenzene	2U	2U

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

BORING RAMW-18D

Depths (ft)	19-21	24-26
Methylene Chloride	2U	2U
1,1-Dichloroethene	1U	1U
1,1-Dichloroethane	1U	1U
trans-1,2-Dichloroethene	1U	1U
Chloroform	2U	2U
1,1,1-Trichloroethane	1U	1U
Trichloroethene	1U	1U
Benzene	1U	1U
Tetrachloroethene	1U	1U
Toluene	1.3	1.8
Chlorobenzene	1.6	1U
Ethylbenzene	1.2	1U
o-Xylene	1.3	1.3
m,p-Xylenes	1.2	1.4
1,3-Dichlorobenzene	2U	2U
1,2-Dichlorobenzene	2U	2U

Table 4. ANALYTICAL RESULTS (ug/kg)
SPIEGELBERG AND RASMUSSEN DUMP SITES

RINSATE SAND

Number	1	2	3	4	5
Methylene Chloride	2U	2U	2U	2U	2U
1,1-Dichloroethene	1U	1U	1U	1U	1U
1,1-Dichloroethane	1U	1U	1U	1U	1U
trans-1,2-Dichloroethene	1U	1U	1U	1U	1U
Chloroform	2U	2U	2U	2U	1U
1,1,1-Trichloroethane	1U	1U	1U	2U	2U
Trichloroethene	1U	1U	1U	1U	1U
Benzene	1U	1U	1U	1U	1U
Tetrachloroethene	1U	1U	1U	1U	1U
Toluene	1U	1U	1U	1U	1U
Chlorobenzene	1U	1U	1.3	1.4	1.5
Ethylbenzene	1U	1U	1U	1U	1U
o-Xylene	1U	1U	1U	1U	1U
m,p-Xylenes	1U	1U	1U	1U	1U
1,3-Dichlorobenzene	2U	2U	1U	1U	1U
1,2-Dichlorobenzene	2U	2U	2U	2U	2U

SECTION V

CONCLUSIONS

Graphs of concentration of various species with depth for borings RAB-A,C,D,F,I are illustrated in Figures 2 through 6. From the data and these Figures, the following conclusions were drawn:

1) 1,1,1-Trichloroethane (TCA) is widespread (borings RAB-A,C,D,F,I) and distributed throughout the soil column. Concentrations range from 110 to 0 ppb.

2) Tetrachloroethene (PERC) is present in borings RAB-C and RAB-D, and distributed throughout the soil column. Concentrations range from 500 to 0 ppb.

3) Substituted benzenes (chlorobenzene, ethylbenzene, toluene, and xylene) are present in RAB-C,D,F and concentrated at or directly above (within 25 feet) the water table. The Concentration ranges and action levels are:

Compound	Range (ppb)
Chlorobenzene	4,800 to 0
Ethylbenzene	3,600 to 0
Toluene	2,900 to 0
Xylene	16,000 to 0

4) Dichlorobenzenes (both 1,2-dichlorobenzene and 1,3-dichlorobenzene) are present in RAB-D with 15 feet of the water table. Concnetrations range from 440 to 0 ppb.

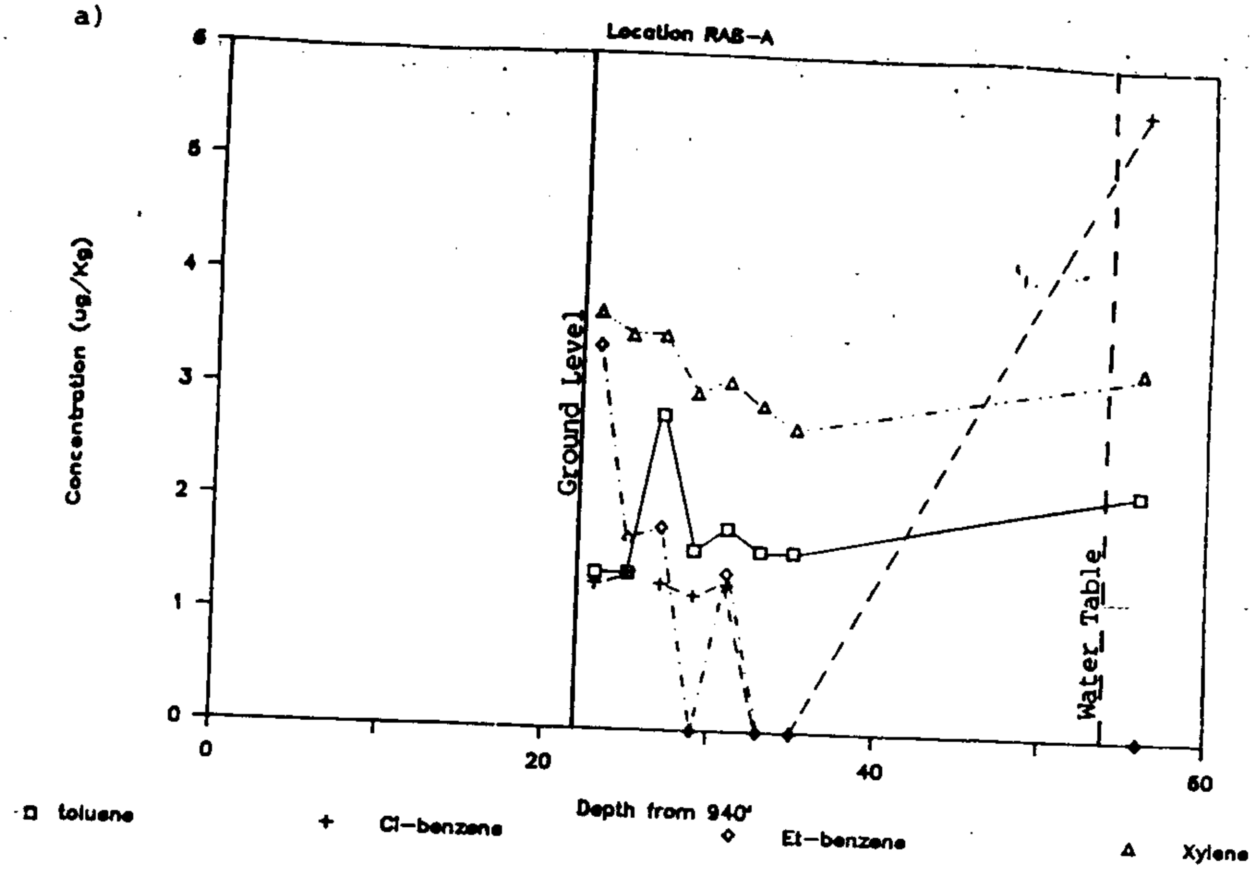
5) At locations RAB-A and MW18D substituted benzenes are present throughout the soil column at concentrations on the order of 1 ppb.

Due to the limited number of boring locations in the PDSLD, it is difficult to determine the spatial extent of contaminants in the soil. Figures 7 through 9 are soil cross-sections of Concentration for perchloroethene, chlorobenzene and toluene, respectively. Additional soil borings are necessary to accurately determine the spatial extent of the PDSLD.

Polychlororated biphenyls (Aroclor-1254) were detected in five samples at four locations. The greatest depth of occurance is 3.0 to 4.5 feet in boring RAB-I. Concentrations range from 1.2 to 0.16 ppb. PCBs were not found5 at depth in the soil column in the PDSLD.

Figure 2. Variations in Concentration with Depth in the Soil for:
a) Substituted Benzenes; b) Volatile Organics.

a)



b)

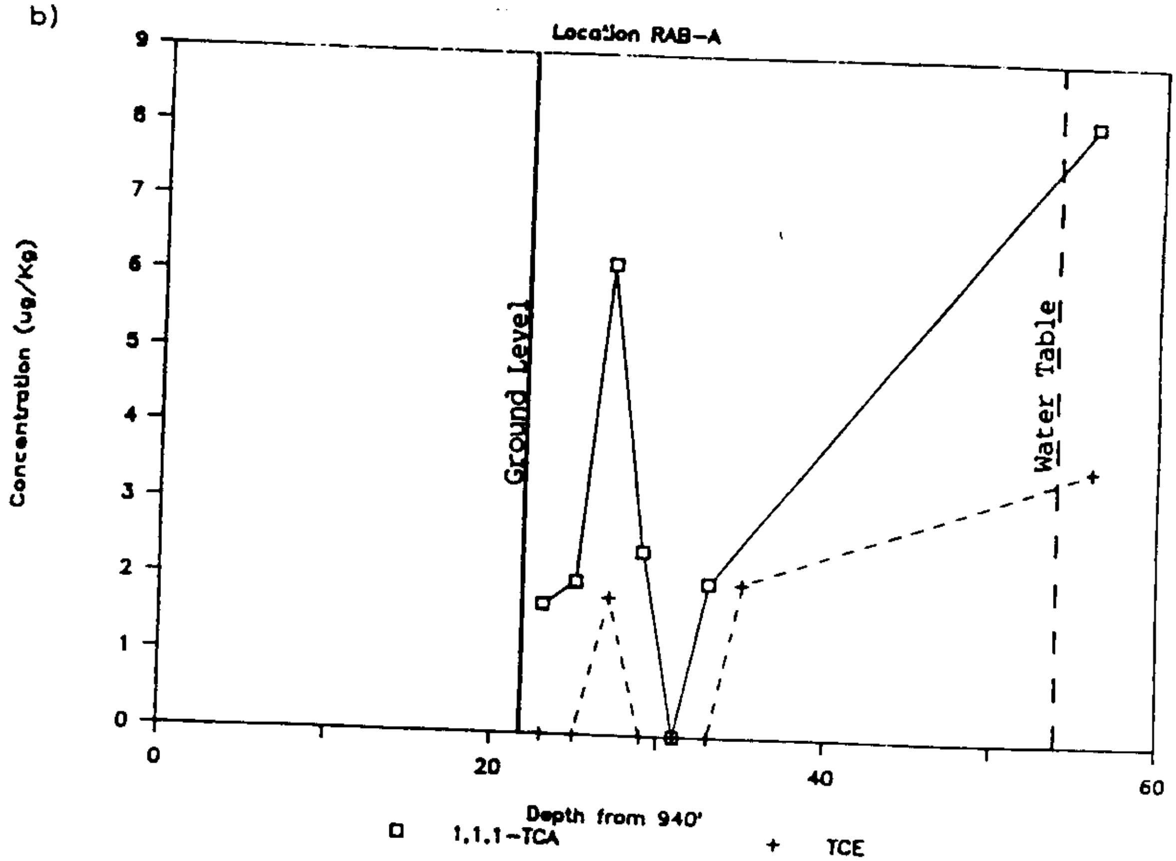
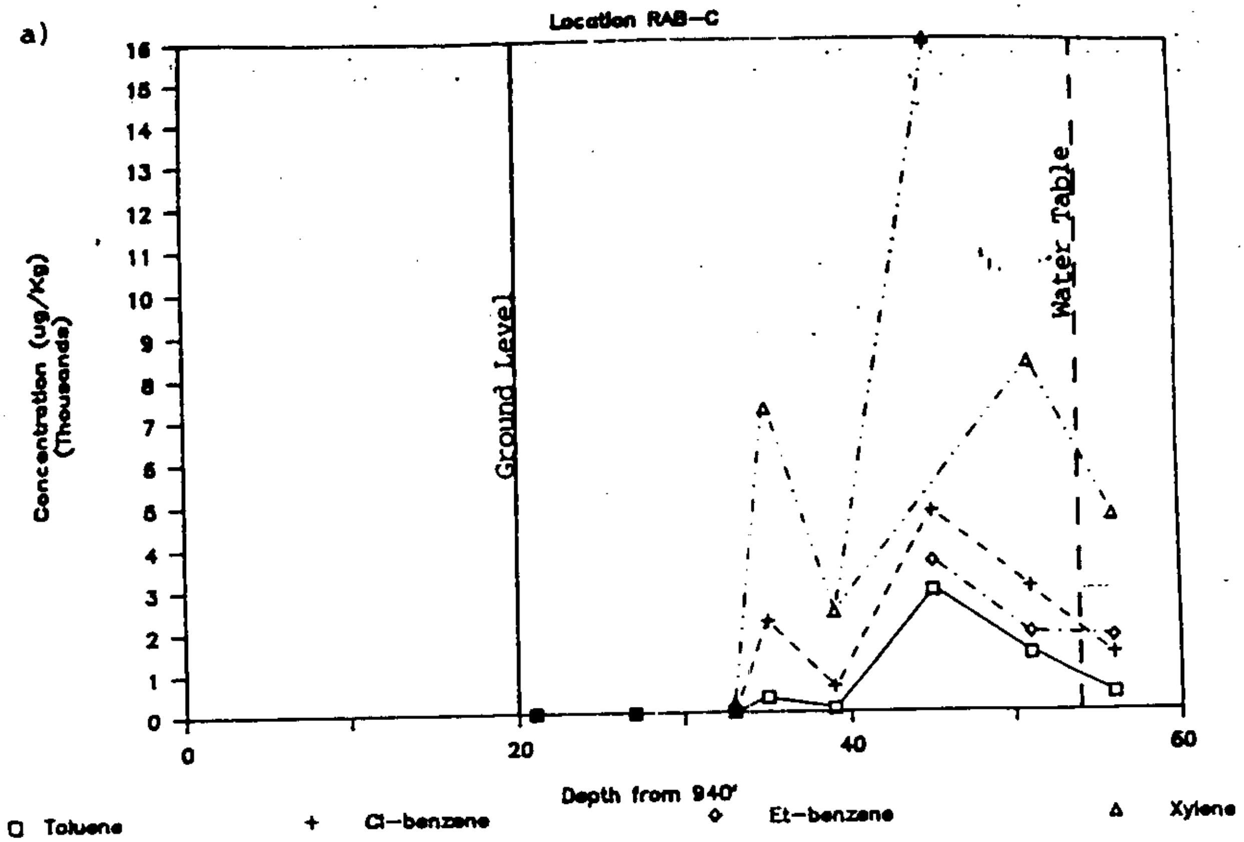


Figure 3. Variations in Concentratio with Depth in the Soil for:
a) Substituted Benzenes; b) Volatile Organics.

a)



b)

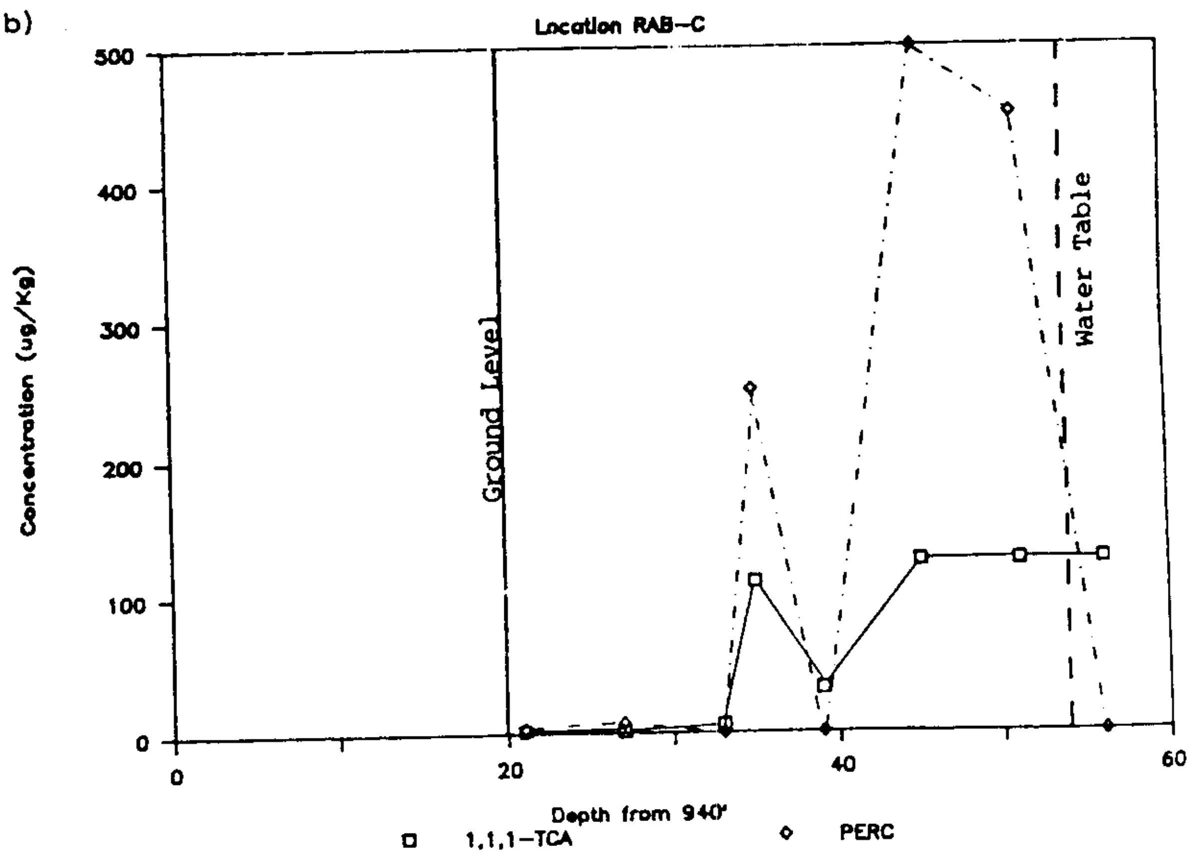
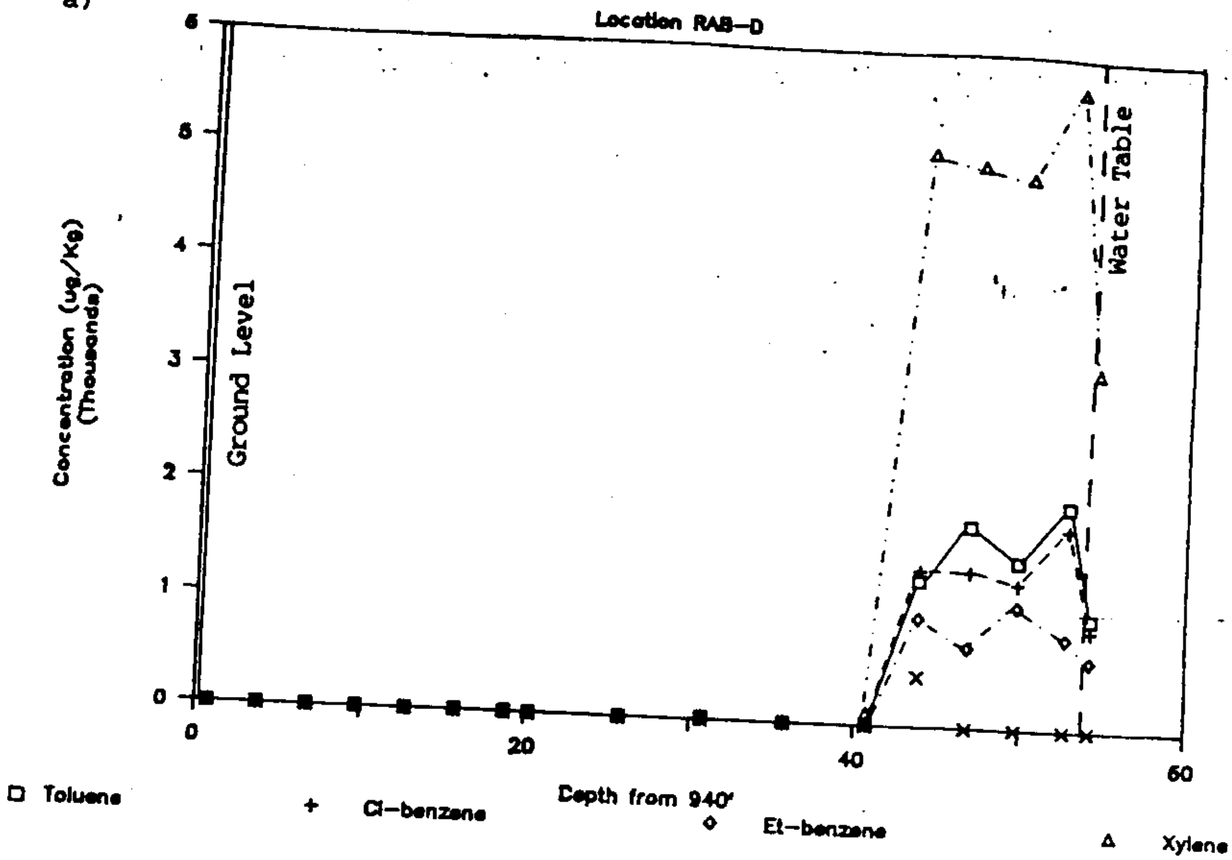


Figure 4. Variations in Concentration with Depth in Soil for:
a) Substituted Benzenes; b) Volatile Organics.

a)



b)

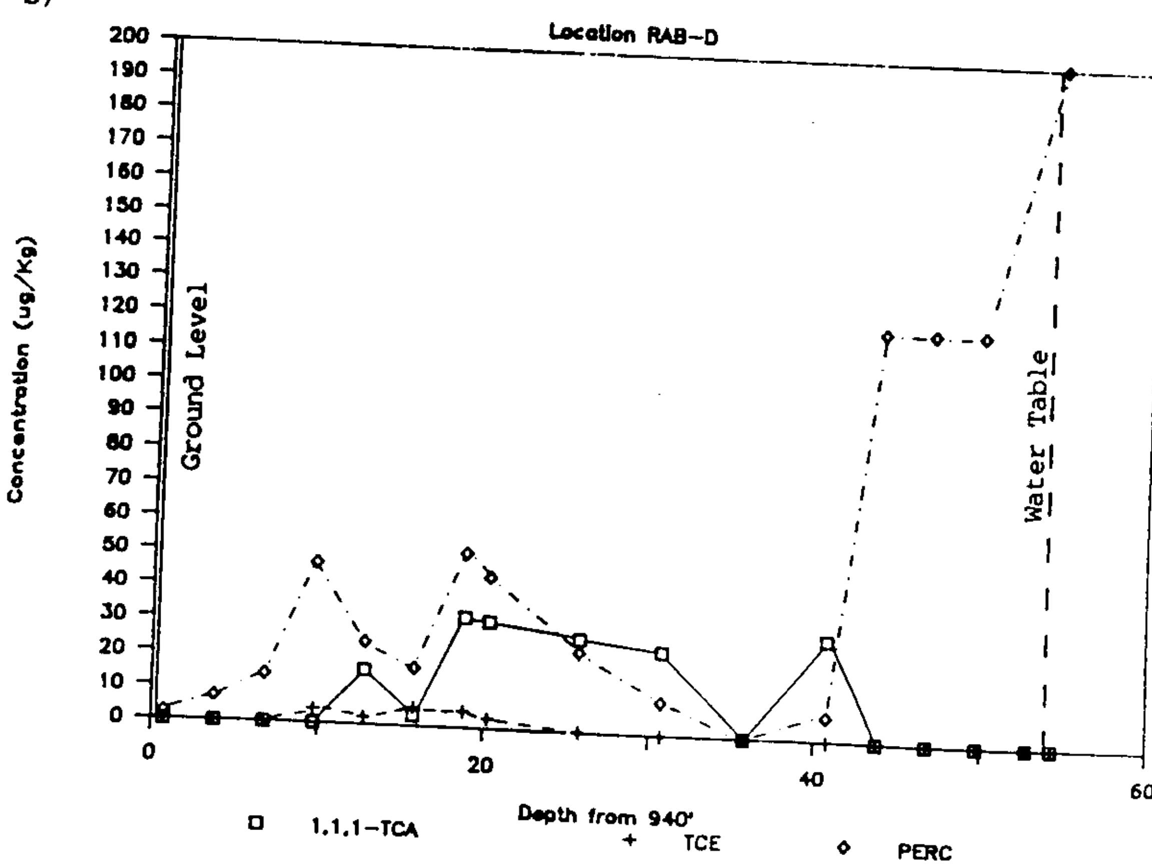
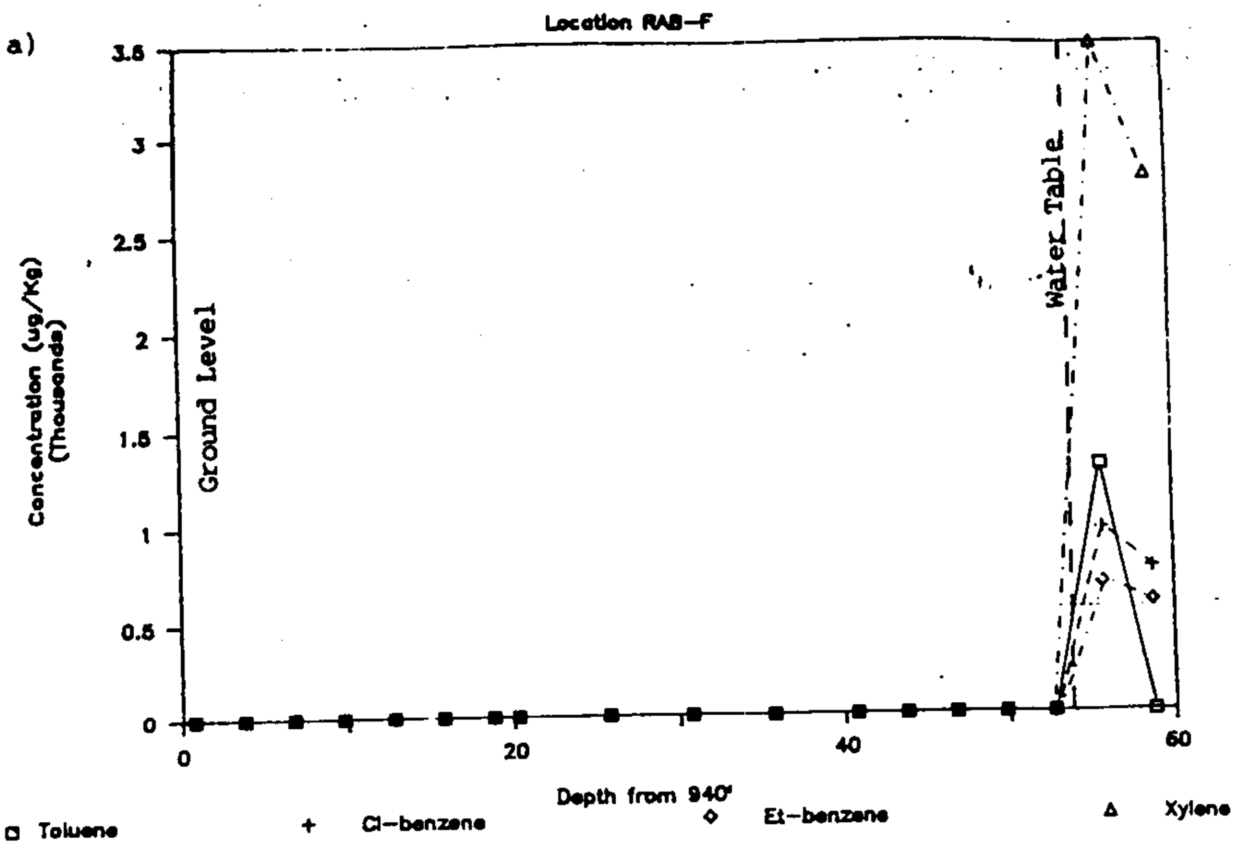


Figure 5. Variations in Concentration with Depth in the Soil for:
a) Substituted Benzenes; b) Volatile Organics.

a)



b)

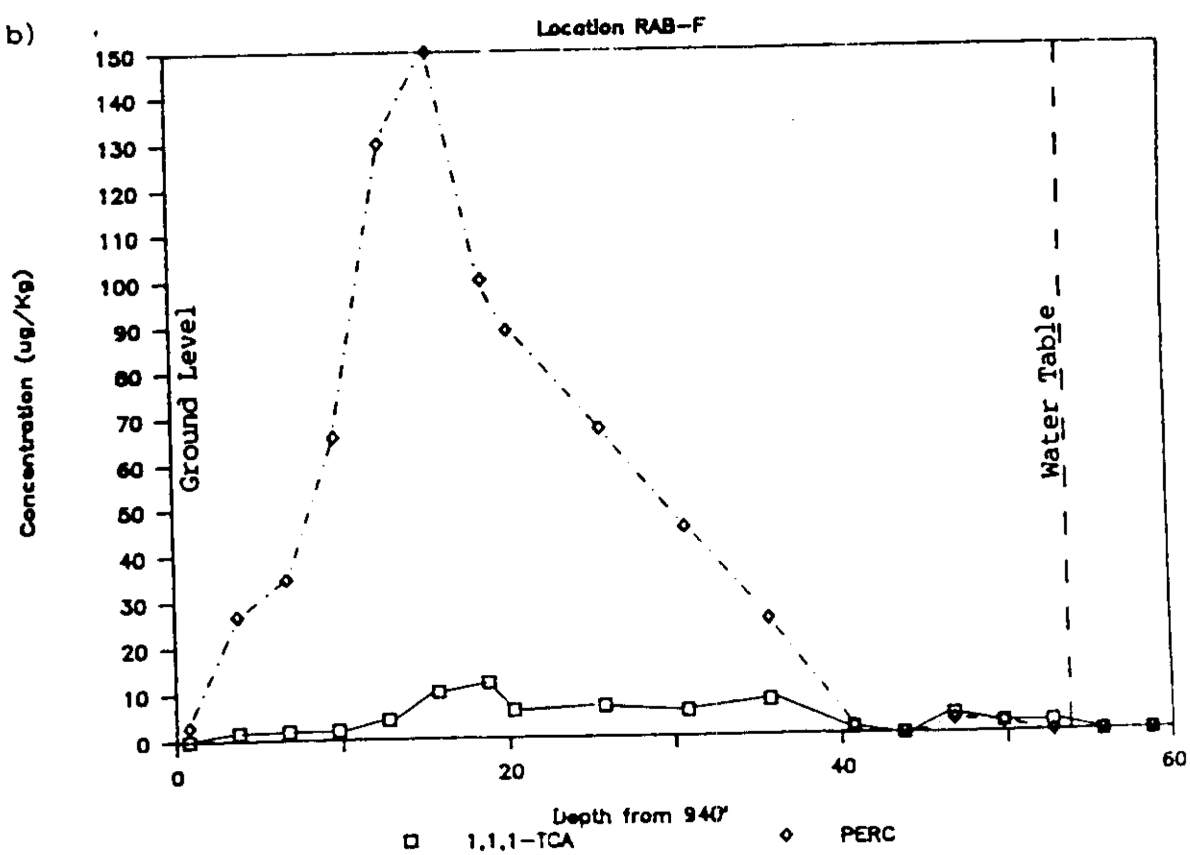
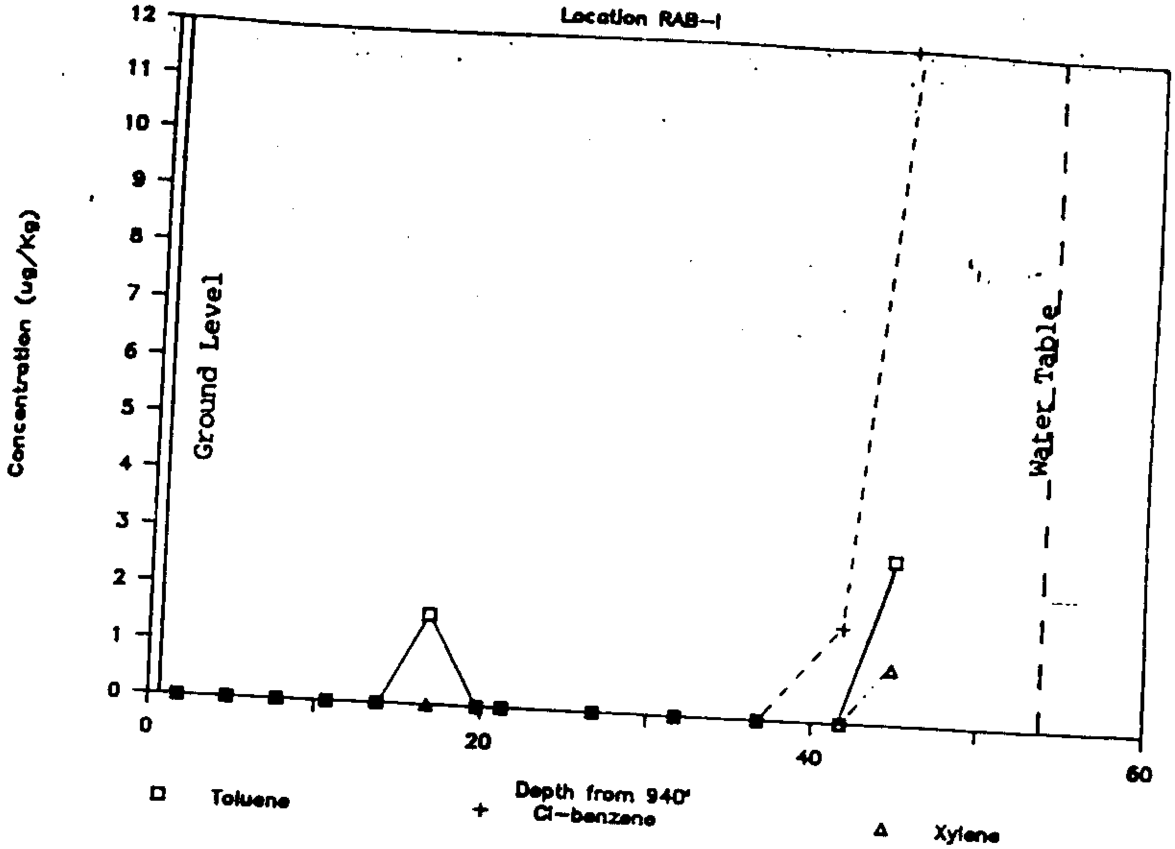


Figure 6. Variations in Concentration with Depth in the Soil for: a) Substituted Benzenes; b) Volatile Organics.

a)



b)

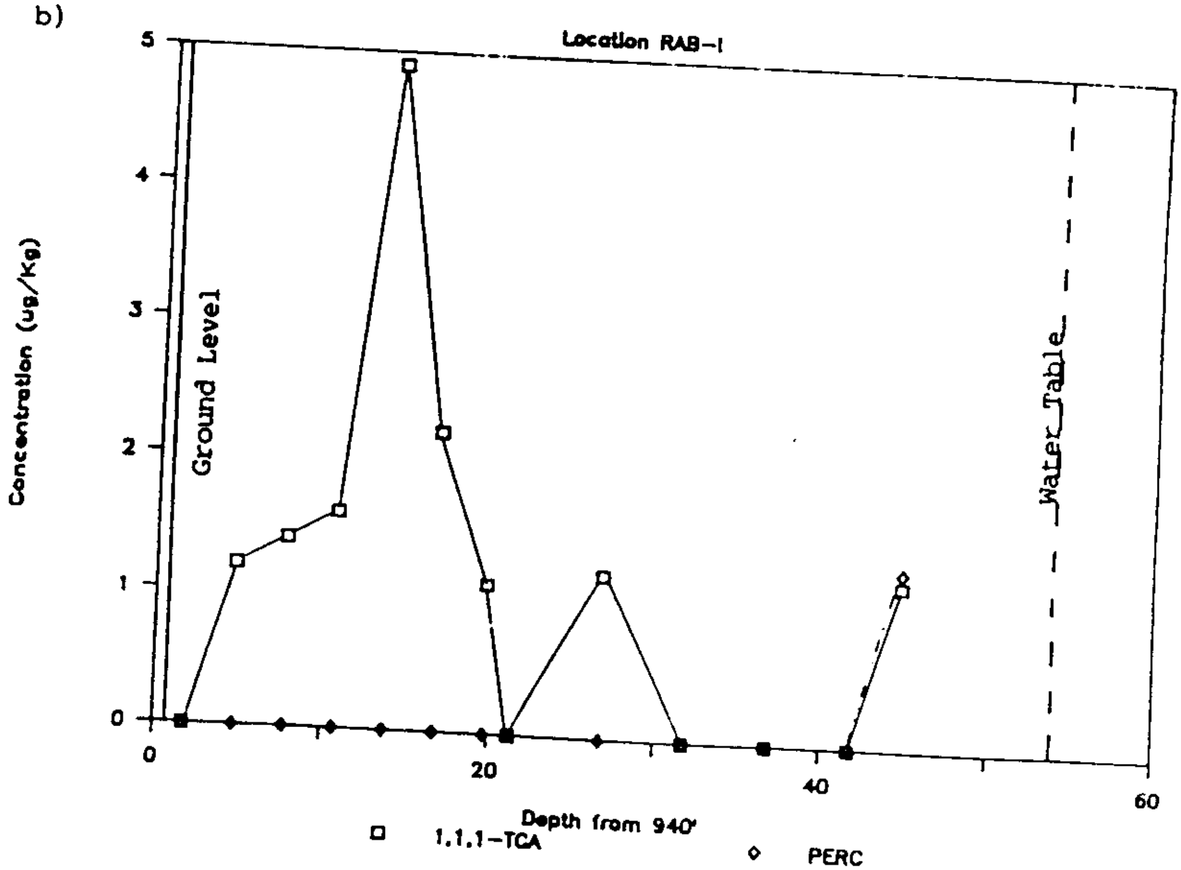


Figure 7. CROSS-SECTION RASMUSSEN SITE

PCE In Soils In ug/Kg

CI = 100 ug/Kg

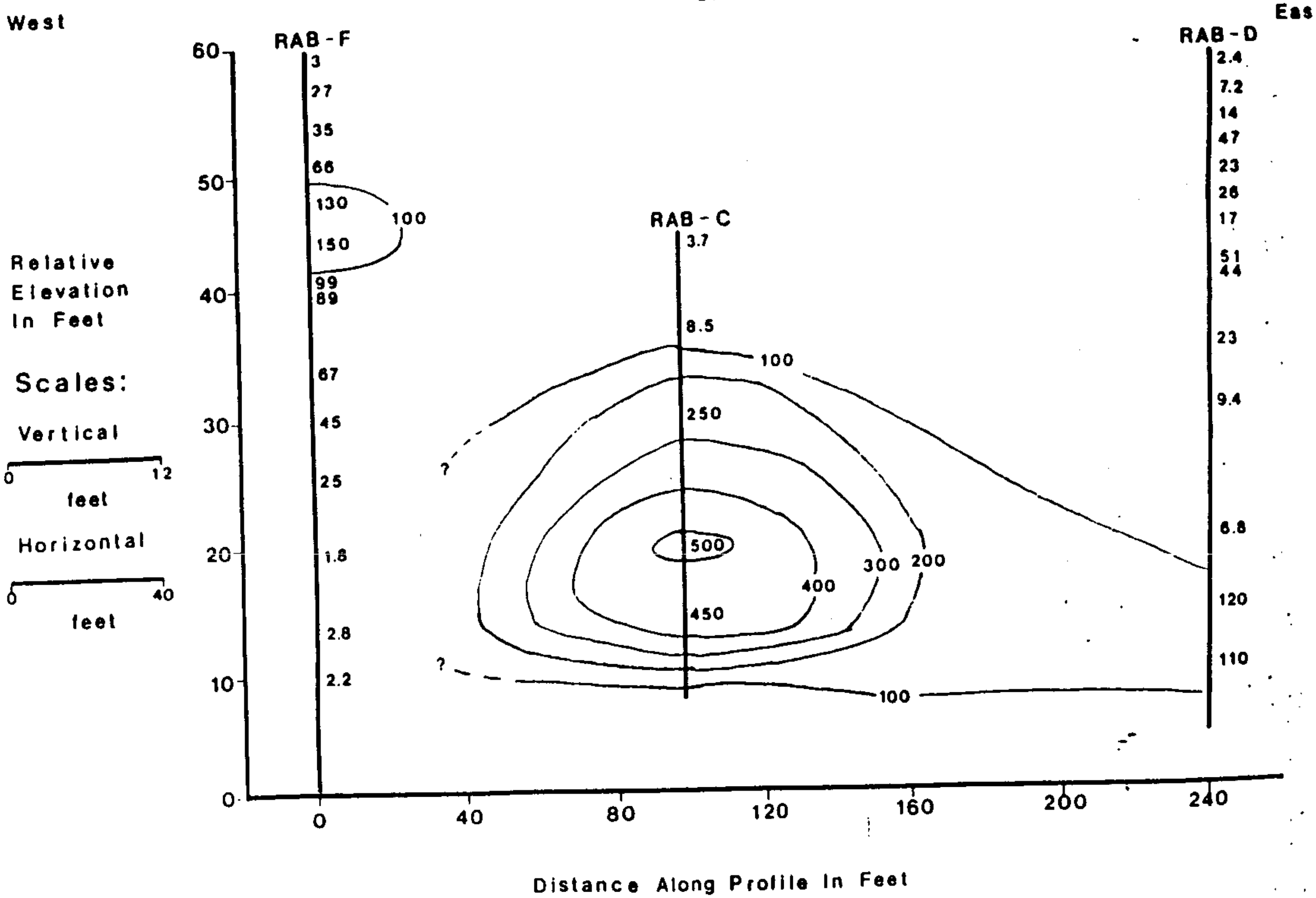


Figure 8. CROSS-SECTION RASMUSSEN SITE

Chlorobenzene In Soils In ug/Kg

Ci = 1000 ug/Kg

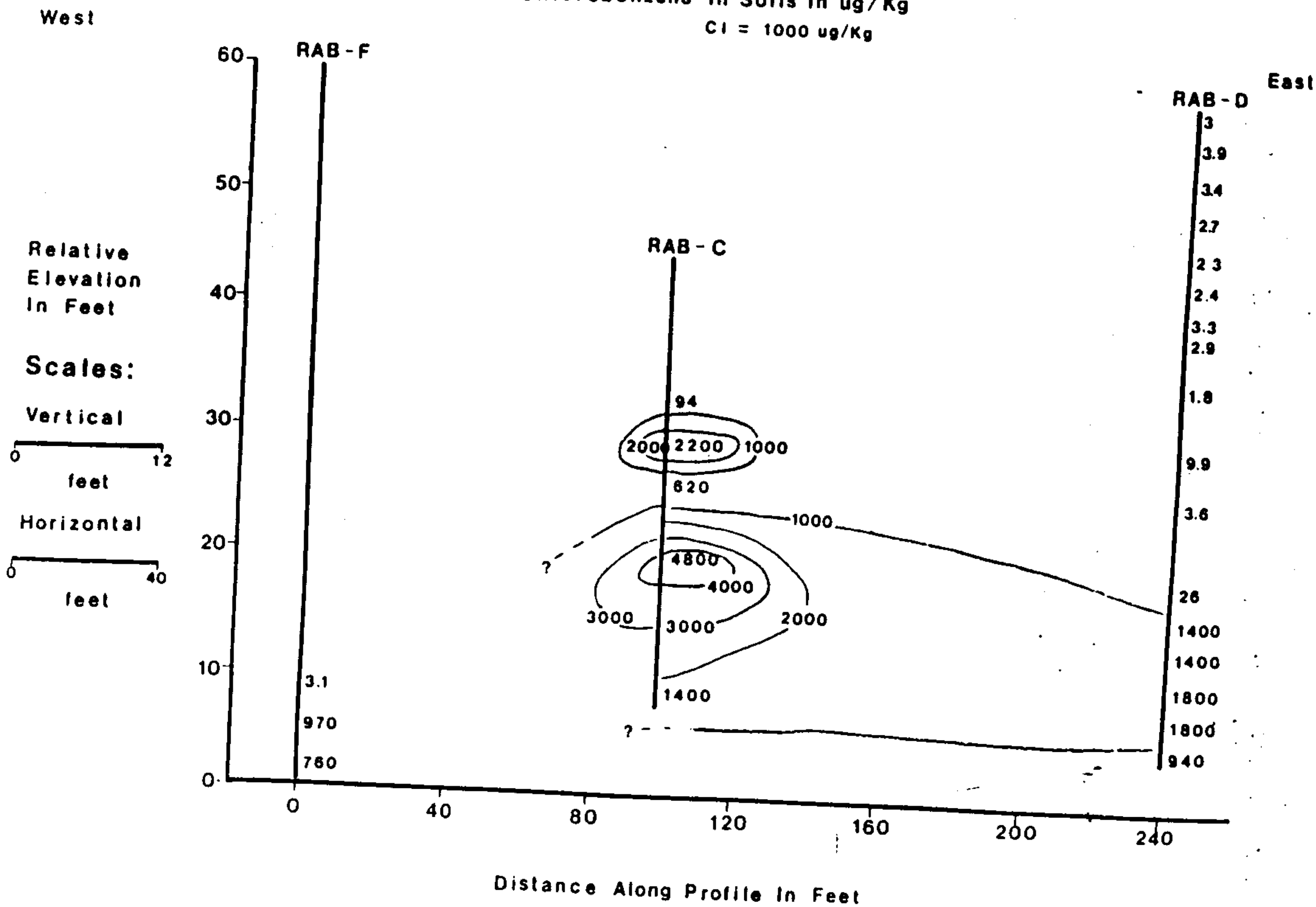
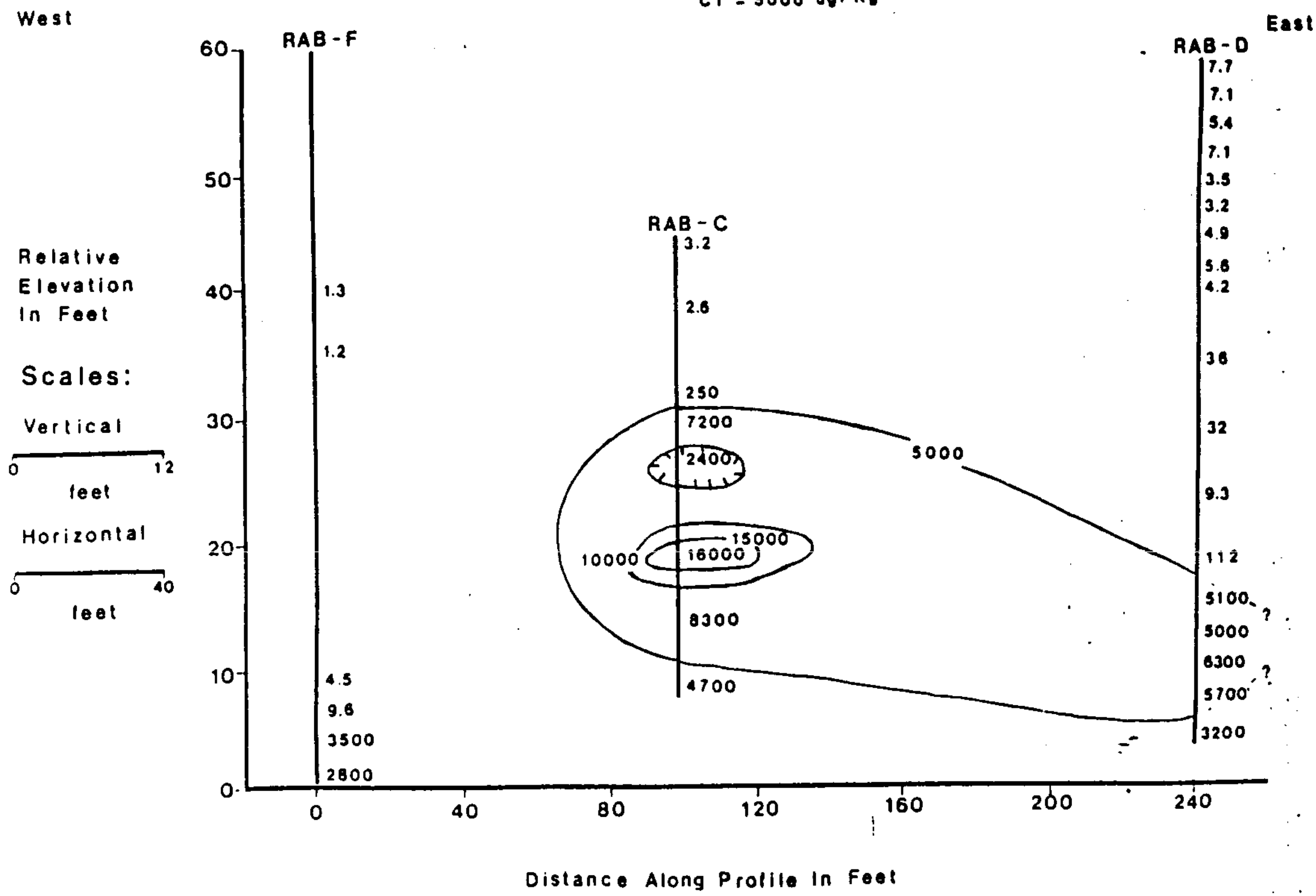


Figure 9. CROSS-SECTION RASMUSSEN SITE

Total Xylenes in Soils in ug/Kg

CI = 5000 ug/Kg



APPENDIX 1.

FIELD NOTES

SECTION II

SAMPLING PROTOCOLS AND PROCEDURES

Soil boring samples were collected from a total of 18 locations, 8 points associated with the PDSLD area and 10 points around the Speigelberg/Rasmussen properties, as identified on Figure 1. The sampling locations were identified prior to the actual sampling, see Figure 1. Eight boring locations (RAB-A thru RAB-I) are new boring locations. The remaining 10 locations are replacement borings of previously sampled locations. Samples were collected for three purposes: lithologic confirmation, selected organics field screening, and laboratory analysis for PCB's.

All soil borings were drilled using a 4.25" ID hollow stem auger, gas or deisel powered drill rig. All samples were collected using a 2" ID split barrel samplers. Prior to drilling and between drilling locations, the drill rig and drilling equipment were decontaminated by steam-cleaning. Where possible, the split barrel sampling device was steam cleaned between samples. If steam cleaning was not possible , the split-barrel sampling device was washed with Alconox solution and rinsed with clean water. Field blanks, using Baker purified sand, were taken at each boring location to test the effectiveness of the decontamination procedures.

The specific sampling protocol which was implemented on site is as follows:

1. The identified sampling location was cleared of loose material, snow, and ice.

2. a) For surface samples, a clean split barrel sampler was driven to the appropriate depth.

   b) For subsurface samples, a hole was drilled to the appropriate depth,using the hollow stem auger drill rig. Then the same procedure used for surface sampling was followed.

3. The split barrel sampler was opened and visually inspected.

4. A 250 mL sampling jar was filled with soil from the length of the sample core for PCB analysis.

5. A 200 mL sampling jar was filled with soil from the length of the sample core for selected organic field screening.

6. A 250 ml sampling jar was filled with soil from the length of the sample core for lithologic confirmation.

7. All jar labels were completed with appropriate information.

8. Sampling data (ie., date, location, blow counts, visual observations, Hnu readings, etc.) was recorded in field note books, and is presented in Appendix 1 .

APPENDIX 4

RISK ASSESSMENT INDICATOR CHEMICALS

TABLE 3-1

INDICATOR CHEMICALS
SPIEGELBERG SITE AND RASMUSSEN DUMP SITE

Contaminants that are Known or Probable Carcinogens	Contaminants with Noncarcinogenic Effects
benzene	acetone
1,1,2,2-tetrachloroethane	2-butanone
1,1,2-trichloroethane	toluene
1,1-dichloroethane	ethylbenzene
tetrachloroethene	chlorobenzene
trichloroethene	total xylenes
1,1-dichloroethene	styrene
vinyl chloride	1,1,1-trichloroethane
chloroform	1,1-dichloroethane
methylene chloride	tetrachloroethene
bis(2-ethylhexyl)phthalate	1,2-dichloroethene
benzo(a)pyrene	1,1-dichloroethene
benzo(a)anthracene	chloroform
benzo(b)fluoranthene	methylene chloride
benzo(k)fluoranthene	bis(2-ethylhexyl)phthalate
chrysene	di-n-butyl phthalate
indeno(1,2,3-cd)pyrene	phenol
PCBs	carbon disulfide
2,3,7,8-TCDD (dioxin)	barium
N-nitrosodiphenylamine	cadmium
cadmium	chromium (III)
nickel	copper
	lead
	nickel
	zinc

APPENDIX 5

RISK ASSESSMENT

CARCINOGENIC RISK

TABLE 3-6

TOTAL CARCINOGENIC RISK
POTENTIAL HOUSEHOLD USE OF GROUNDWATER
SPIEGELBERG SITE AND RASMUSSEN DUMP SITE

Source Area	Maximum Source Conc.		Average Source Conc.	
	α_T = 1m	α_T = 10m	α_T = 1m	α_T = 10m
Existing Plume-Spiegelberg	3.83×10^{-3}	7.29×10^{-4}	1.90×10^{-3}	3.62×10^{-4}
Existing Plume - Rasmussen	6.23×10^{-3}	2.04×10^{-3}	6.78×10^{-4}	2.22×10^{-4}
Top of Municipal Landfill	2.12×10^{-4}	2.83×10^{-5}	3.88×10^{-5}	5.18×10^{-6}
Northeast Buried Drum Area	1.22×10^{-3}	1.53×10^{-4}	2.82×10^{-4}	3.53×10^{-5}
Industrial Waste Area	1.62×10^{-4}	1.55×10^{-5}	3.20×10^{-5}	3.05×10^{-6}
Probable Drum Storage/Leakage/ Disposal Area	1.35×10^{-6}	1.89×10^{-7}	3.15×10^{-7}	4.42×10^{-8}
Berm Area	5.46×10^{-6}	7.12×10^{-7}	1.82×10^{-6}	2.37×10^{-7}

For input parameters and assumptions, see Section 3.4.4.1 and Appendix B.

TABLE 3-7

TOTAL CARCINOGENIC RISK
DIRECT DERMAL CONTACT WITH SURFACE SOILS
RASMUSSEN DUMP SITE

Source Area	Worst-Case Scenario	Plausible-Case Scenario
Municipal Landfill Area	1.21×10^{-4}	1.08×10^{-5}
Area of Reported Burning	8.96×10^{-6}	8.47×10^{-7}
Industrial Waste Area	4.42×10^{-6}	5.47×10^{-7}
Probable Drum Storage Area	3.13×10^{-5}	1.17×10^{-6}
Berm Area	6.34×10^{-6}	5.29×10^{-7}
Northeast Buried Drum Area	1.23×10^{-6}	2.13×10^{-7}

For input parameters and assumptions, see Section 3.4.4.2 and Appendix C.

TABLE 3-9

TOTAL CARCINOGENIC RISK
FUGITIVE DUST EMISSIONS
RASMUSSEN DUMP SITE

Area of Concern	Worst-Case Scenario	Plausible-Case Scenario
Municipal Landfill Area	1.56×10^{-7}	6.02×10^{-9}
Industrial Waste Area	6.07×10^{-9}	4.40×10^{-10}
Probable Drum Storage Area	1.72×10^{-9}	2.39×10^{-10}
Berm Area	6.34×10^{-9}	2.79×10^{-10}
Northeast Buried Drum Area	5.52×10^{-10}	4.79×10^{-11}

For input parameters and assumptions, see Section 3.4.4.3 and Appendix D.

APPENDIX 6

HAZARD INDICES

TABLE 3-11

TOTAL HAZARD INDICES, POTENTIAL HOUSEHOLD USE OF GROUNDWATER
SPIEGELBERG SITE AND RASMUSSEN DUMP SITE

Source Area	Maximum Source Conc.		Average Source Conc.	
	α_T = 1m	α_T = 10m	α_T = 1m	α_T = 10m
Existing Plume-Spiegelberg	10.4	1.98	3.56	0.68
Existing Plume - Rasmussen	53.1	17.4	8.99	2.95
Top of Municipal Landfill	0.92	0.12	0.13	0.02
Northeast Buried Drum Area	7.56	0.94	0.94	0.12
Industrial Waste Area	0.06	0.006	0.01	0.001
Probable Drum Storage/ Leakage/Disposal Area	0.08	0.01	0.02	0.002
Berm Area	0.10	0.01	0.04	0.005

For input parameters and assumptions, see Section 3.4.4.1 and Appendix B.

TABLE 3-12

TOTAL HAZARD INDICES
DIRECT DERMAL CONTACT WITH SURFACE SOILS
RASMUSSEN DUMP SITE

Source Area	Worst-Case Scenario	Plausible-Case Scenario
Municipal Landfill Area	1.47×10^{-2}	3.71×10^{-3}
Industrial Waste Area	1.18×10^{-3}	4.04×10^{-4}
Probable Drum Storage Area	2.76×10^{-2}	3.98×10^{-3}
Berm Area	4.44×10^{-3}	2.77×10^{-4}

For input parameters and assumptions, see Section 3.4.4.2 and Appendix C.

TABLE 3-14

TOTAL HAZARD INDICES (FOR CHILDREN)
FUGITIVE DUST EMISSIONS
RASMUSSEN DUMP SITE

Area of Concern	Worst-Case Scenario	Plausible-Case Scenario
Municipal Landfill Area	4.13×10^{-6}	1.85×10^{-7}
Industrial Waste Area	3.44×10^{-11}	2.13×10^{-12}
Probable Drum Storage Area	2.11×10^{-5}	2.56×10^{-7}
Berm Area	3.61×10^{-11}	1.27×10^{-12}

For input parameters and assumptions, see Section 3.4.4.3 and Appendix D.

STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF NATURAL RESOURCES

STEVENS T. MASON BUILDING
P.O. BOX 30028
LANSING, MI 48909

DAVID F. HALES, Director

March 28, 1991

Mr. Valdas Adamkus, Regional Administrator
U.S. Environmental Protection Agency
Region V, 5RA-14
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Adamkus:

The Michigan Department of Natural Resources (MDNR), on behalf of the State of Michigan, has reviewed the Record of Decision (ROD) for the Rasmussen Dump Site final remedial action, and the proposed remedy contained in that ROD. Michigan concurs with the remedy proposed in the ROD consisting of groundwater extraction and treatment, reinjection of treated groundwater via seepage basins to enhance contaminant migration and uptake, Michigan Act 64 capping of the dump and associated contaminated soil areas, deed restrictions and fencing to provide for the integrity of the remedy, and monitoring of groundwater and residential wells in the area.

The State also concurs with the analysis of legally applicable or relevant and appropriate requirements (ARARs) contained in Tables 2 and 3 of the ROD with respect to those ARARs identified in those tables. The State does not concur with the omission from that table, and from other references, of the Michigan Water Resources Commission Act 245, PA 1929, MCL 323.6(1) and the associated Part 22 Administrative Rules MAC R.323.2201 et.seq. The State has previously identified these requirements as ARARs for the remedial action being selected for this site.

The Water Resources Commission Act and the Part 22 Rules are ARARs for this remedial action for two reasons. First, hazardous substances in the aquifer beneath the site are migrating to degrade previously uncontaminated groundwater. Second, one element of the selected remedial action is discharge of purged, treated water back into the aquifer via seepage basins.

It is the Department's judgement that the selected remedial action for this site will provide for attainment of all ARARs including the Michigan Water Resources Commission Act Part 22 Rules. The remedial action will halt the migration of contaminated groundwater and restore the aquifer to a usable condition. The capping portion of the remedy will prevent future degradation of the groundwater resource by preventing water infiltration. In addition, purged water will be treated prior to reinjection and then hydraulically contained on-site by the purge wells in a manner that will also prevent degradation of groundwater quality, consistent with the Water Resources Commission Act and Part 22 Rules.

We are pleased to be partners with you in selecting this remedy and look forward to working together to accomplish the final remedy at this site.

Sincerely,

Delbert Rector

Delbert Rector
Deputy Director
517-373-7917

cc: Ms. Susan Schneider, US DOJ
Mr. Jon Dikinis, US EPA
Ms. Alison Gavin, US EPA, ORC
Ms. Wendy Carney, US EPA
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